

# DEMYSTIFYING AGEING

## LIFTING THE BURDEN OF FRAGILITY FRACTURES AND OSTEOPOROSIS IN ASIA-PACIFIC

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## EXECUTIVE SUMMARY

Fragility fractures<sup>1</sup> are already a significant public health challenge across Asia-Pacific. Their lasting impact on societies and economies is well-documented, leading to loss of mobility, independence and, in some instances, death for their elderly sufferers. In many traditional Asia-Pacific societies, where older people often serve as caregivers for younger generations, fractures can devastate entire families and communities. From a broader perspective, the cost of treating hip fractures in Asia-Pacific societies equates to 19% of GDP per capita, underscoring the enormity of the problem.

As populations age, many believe fragility fractures will become more widespread, yet this is not necessarily the case. Osteoporosis, a condition that makes bones more likely to break and a leading cause of fractures, was within living memory thought to be a natural part of ageing. This myth is gradually being dispelled. The condition is preventable and treatable—a fact which receives too little attention across the region. This study looks at the challenge fragility fractures and osteoporosis pose and how health systems are responding in eight Asia-Pacific economies: Australia, Hong Kong, Japan, New Zealand, Singapore, South Korea, Taiwan and Thailand (called collectively in the text the “scorecard economies”). The key findings are:

- **Health systems need to do more to respond to rising numbers of fracture and osteoporosis prevalence driven by ageing.** Of the main risk factors, by far the most common is ageing. Already many developed Asia-Pacific economies have seen fragility fracture rates rise as the population has grown older. This upward trend will likely continue: in Singapore, South Korea and Taiwan, for example, the proportion of people over 50 years old will rise from around a third in 2015 to about half by 2035.
- **A fracture epidemic is preventable.** Many therapies are available which can reduce the probability of sustaining an osteoporosis-related fracture. Since the 1990s, healthcare systems have become equipped to measure bone mineral density (BMD), assess fracture risk, give appropriate dietary and lifestyle guidance to maintain skeletal integrity, and prescribe effective medications where necessary. These can either prevent BMD from declining to a degree where osteoporosis is diagnosed, or reverse the decline.
- **The awareness of, and attention to, osteoporosis and the fractures that come in its wake varies and is often insufficient.** Similarities, though, are common in three main groups:
  - *Governments:* despite notable exceptions, such as New Zealand and Singapore, health officials and government ministers prove difficult to engage on the disease. Lack of data, cost considerations and a higher priority assigned to other non-communicable diseases (NCDs) impede fractures and osteoporosis receiving the necessary attention.
  - *Medical professionals:* healthcare systems have only developed effective responses to osteoporosis in the last two decades. As a result, until recently, awareness of osteoporosis and its treatment were inadequate among clinicians who did not specialise in it. Efforts of professional societies, NGOs and health officials in some places have raised awareness substantially, though more work remains to be done.
  - *The public:* this may be the least engaged stakeholder. Although increasingly, people across Asia-Pacific have heard of the disease, knowledge of risk factors is missing or incomplete, the protective power of calcium on its own overrated, and the assumption that osteoporosis “won’t affect me” widespread. Such ignorance reduces the likelihood of early diagnosis and, even where diagnosis occurs, a substantial number of patients end up discontinuing treatment, for various reasons.

<sup>1</sup> This study uses the term “fragility fractures” to refer to osteoporotic fragility fractures

- **Data on fragility fractures and osteoporosis urgently need improvement.** Work on the scorecard revealed striking information gaps in such areas as internationally comparable hip fracture rates and osteoporosis prevalence. Different strategies, such as the creation of specialist registries and the mining of national health system databases, can go some way toward addressing these data deficiencies. More information would help improve evidence-based assessment of interventions and demonstrate the urgency of the issue to policymakers.
- **A multi-stakeholder approach is required to tackle the problem from various angles.** Effective solutions are more likely to be comprehensive rather than specific. They include initiatives like fracture liaison services (FLSs), which integrate different kinds of osteoporosis treatment and secondary prevention around the patient, and co-ordinated alliances of government, health professionals, patient groups and NGOs, which help make sure a range of policies and initiatives all point in the same direction. Relevant interventions range from drugs therapy to promoting neighbourhoods that encourage exercise and reduce falls. While some progress has been made, more is urgently needed.

## ABOUT THE RESEARCH

This paper is based on the findings of the Asia-Pacific fracture and osteoporosis scorecard, created by The Economist Intelligence Unit (EIU) and sponsored by Amgen, along with 21 in-depth interviews with global experts. The scorecard was developed to assess the burden and response of health systems in addressing fragility fractures and osteoporosis, over eight economies: Australia, Hong Kong, Japan, New Zealand, Singapore, South Korea, Taiwan and Thailand.

We would like to thank the following experts (listed alphabetically by surname) for contributing their time and insight:

- Manju Chandran, director, osteoporosis and bone metabolism unit, Singapore General Hospital
- Eddie Chow, rehabilitation specialist and president, The Osteoporosis Society of Hong Kong
- Cyrus Cooper, president, International Osteoporosis Foundation and professor of musculoskeletal science, Universities of Southampton and Oxford (United Kingdom)
- Peter R Ebeling, AO, medical director, Osteoporosis Australia
- Yong-Chan Ha, orthopaedic surgeon, Chung-Ang University College of Medicine (South Korea)
- Gill Hall, manager, rehabilitation and falls prevention lead, Accident Compensation Corporation (New Zealand)
- Famida Jiwa, president and chief executive officer, Osteoporosis Canada, and chair, patient societies subcommittee of the committee of national societies, International Osteoporosis Foundation
- Tang Ching Lau, rheumatologist, National University Hospital and immediate past president, Osteoporosis Society (Singapore)
- Ka-Kui Lee, endocrinologist (private practice) and former president, The Osteoporosis Society of Hong Kong
- Toshio Matsumoto, professor, Fujii Memorial Institute of Medical Sciences, University of Tokushima (Japan)
- Paul Mitchell, chair, Osteoporosis New Zealand
- Ambrish Mithal, chairman and head, endocrinology and diabetes division, Medanta Medicity, Gurgaon (India)
- Kensuke Moriwaki, lecturer, medical statistics, Kobe Pharmaceutical University (Japan)
- Boonsong Ongphiphadhanakul, professor, division of endocrinology and metabolism, department of medicine, Ramathibodi Hospital Mahidol University and president, Thai Osteoporosis Foundation
- Hajime Orimo, president, Japan Osteoporosis Foundation
- Hyoung Moo Park, orthopaedic surgeon, department of obstetrics and gynaecology, Chung Ang University (South Korea)

- Kerrie Sanders, professor, Institute for Health & Ageing, Australian Catholic University
- Thawee Songpatanasilp, professor, division of orthopaedic surgery, Bumrungrad International Hospital and vice-president, Thai Osteoporosis Foundation
- Ying-Wei Wang, director-general, Health Promotion Administration (Taiwan)
- Sze Hung Wong, honorary clinical associate professor, University of Hong Kong and council member, The Osteoporosis Society of Hong Kong
- Chih-Hsing Wu, associate professor, National Cheng Kung University Medical Center and president, Taiwanese Osteoporosis Association

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# INTRODUCTION: ASIA-PACIFIC'S FRACTURE AND OSTEOPOROSIS CHALLENGE

<sup>2</sup> WHO, *Guidelines for preclinical evaluation and clinical trials in osteoporosis*, 1998

<sup>3</sup> Katherine Forest, "Hip fractures in adults", <https://www.uptodate.com/contents/hip-fractures-in-adults>, found a range of 12% to 37% among various US and European studies

<sup>4</sup> Patrick Haentjens et al, "Meta-analysis: Excess Mortality After Hip Fracture Among Older Women and Men", *Annals of Internal Medicine*, 2010

<sup>5</sup> Suzanne Dyer, "A critical review of the long-term disability outcomes following hip fracture", *BMC Geriatrics*, 2016

<sup>6</sup> KS Leung et al, "How well are we managing fragility hip fractures? A narrative report on the review with the attempt to set up a Fragility Fracture Registry in Hong Kong", *Hong Kong Medical Journal*, 2017

<sup>7</sup> Kyae Hyung Kim et al, "Prevalence, awareness, and treatment of osteoporosis among Korean women: The Fourth Korea National Health and Nutrition Examination Survey", *Bone*, 2012

<sup>8</sup> Michelle Lai et al, "Undertreatment of osteoporosis in regional Western Australia", *Australasian Journal on Ageing*, 2012

<sup>9</sup> John Kanis on behalf of the World Health Organization Scientific Group, *Assessment of osteoporosis at the primary health-care level. Technical Report*, 2007

<sup>10</sup> Australian Institute of Health and Welfare, *Estimating the prevalence of osteoporosis in Australia*, 2014; Eun Jung Park et al, "Prevalence of Osteoporosis in the Korean Population Based on Korea National Health and Nutrition Examination Survey (KNHANES), 2008-2011", *Yonsei Medical Journal*, 2014; S Wade et al, "Estimating prevalence of osteoporosis: examples from industrialized countries", *Archives of Osteoporosis*, 2014; Yi-Chin Lin and Wen-Harn Pan, "Bone mineral density in adults in Taiwan: results of the Nutrition and Health Survey in Taiwan 2005-2008", *Asia Pacific Journal of Clinical Nutrition*, 2011

<sup>11</sup> Jongseok Lee et al, "Age-Related Changes in the Prevalence of Osteoporosis according to Gender and Skeletal Site: The Korea National Health and Nutrition Examination Survey 2008-2010", *Endocrinology and Metabolism*, 2013

<sup>12</sup> Institute for Health Metrics and Evaluation, *Global Burden of Disease Study 2015*, GBD Results Tool, <http://ghdx.healthdata.org/gbd-results-tool>

## *Fragility fractures and their silent accomplice*

Fragility fractures are defined by the WHO as those "caused by injury that would be insufficient to fracture normal bone".<sup>2</sup> They commonly occur in the wrist, spine and hip. The latter in particular can be devastating, with national one-year mortality rates as high as 37%.<sup>3</sup> Nor do survivors escape harm: mobility is often permanently impaired, and independence suffers as a result. Many must be looked after in long-term care facilities. These issues afflict Western and Asian countries alike; the following table summarises a number of studies examining the human toll of hip fractures.

**Table I. Facing the pain of hip fractures**

### Fracture patients are...

- 2.9/3.7 times more likely to die than uninjured peers (women/men)<sup>4</sup>

### Among those who suffer a fracture...<sup>5</sup>

- 40%-60% recover their pre-fracture mobility level
- 10%-20% are institutionalised

### Among hip fracture patients in Hong Kong...<sup>6</sup>

- 70% continued to experience worse mobility one year later
- 23% who had previously lived at home entered nursing homes

Much of this suffering results from a silent disease: though not all broken bones are fragility fractures, as Famida Jiwa of the International Osteoporosis Federation (IOF) notes, "Over 80% percent of all fractures over the age of 50 have a basis in osteoporosis." This is particularly alarming because most people are unaware they have the condition. For example, a minority of Korean women who were found to have osteoporosis had previously been aware of the diagnosis.<sup>7</sup> Similarly, less than a third of Australian women know that they have the disease until they have a fracture.<sup>8</sup>

Among the very oldest women, the condition is the rule rather than the exception: globally, approximately one in four women in their 80s, and two in five of those in their 90s, have it.<sup>9</sup> In some Asia-Pacific economies, the numbers are starker still, ranging from 23%-38% of women over 50. Inevitably, for older age groups, the figures rise markedly:<sup>10</sup> nearly two in three Korean women in their 70s and 86% in their 80s have measurable osteoporosis at one major bone site at least. Almost all the rest have osteopenia.<sup>11</sup>

Low BMD multiplies other common risks in daily life. According to the World Health Organization (WHO), among those aged over 50, 18% of deaths from road accidents and 60% of deaths from falls are attributable to low BMD. Indeed, falls are associated with much of the health burden ultimately caused by low BMD.<sup>12</sup>



**There is a line between decreased bone density and a diagnosis of osteoporosis. A curved back, resulting from multiple vertebral fractures, is not a natural part of ageing and should not occur.**

*Famida Jiwa, chair, patient societies subcommittee of the committee of national societies, International Osteoporosis Foundation*

<sup>13</sup> WHO, *Assessment of fracture risk and its application to screening for post-menopausal osteoporosis*, 1994

<sup>14</sup> John Kanis et al, "The diagnosis of osteoporosis", *Journal of Bone and Mineral Research*, 1994

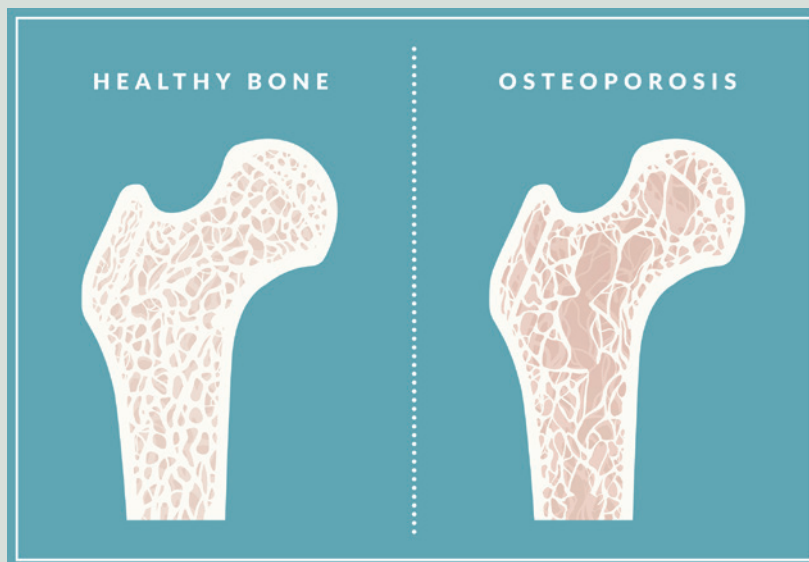
<sup>15</sup> Stavros Manolagas, "Birth and Death of Bone Cells: Basic Regulatory Mechanisms and Implications for the Pathogenesis and Treatment of Osteoporosis", *Endocrine Reviews*, 2012

<sup>16</sup> Robert Heany et al, "Peak Bone Mass", *Osteoporosis International*, 2001; some studies challenge the extent to which early years' intervention has a long-term effect (for example, Rachel Gafni and Jeffrey Baron, "Childhood Bone Mass Acquisition and Peak Bone Mass May Not Be Important Determinants of Bone Mass in Late Adulthood", *Pediatrics*, 2007)

## BOX I. BONE MINERAL DENSITY AND OSTEOPOROSIS

Osteoporosis is defined as having a BMD 2.5 standard deviations or more below the average value for a young healthy person, according to the WHO.<sup>13</sup> Less severe but still problematic levels of BMD are called osteopenia.<sup>14</sup> This number of standard deviations, or "t-score", can be as good a predictor of fracture as long-term blood pressure readings are of heart stroke, according to Cyrus Cooper of the IOF.

Poor bone development during one's early years, typically due to calcium or vitamin D deficiency, is presumed to leave one more likely to develop osteoporosis later.<sup>16</sup> In a broader sense, lifestyle factors, including alcohol consumption and smoking, as well as a variety of drug classes, and even too much vitamin A in the form of retinol, can lower BMD. On the other hand, exercise, vitamin D and calcium slow the extent of the decline.

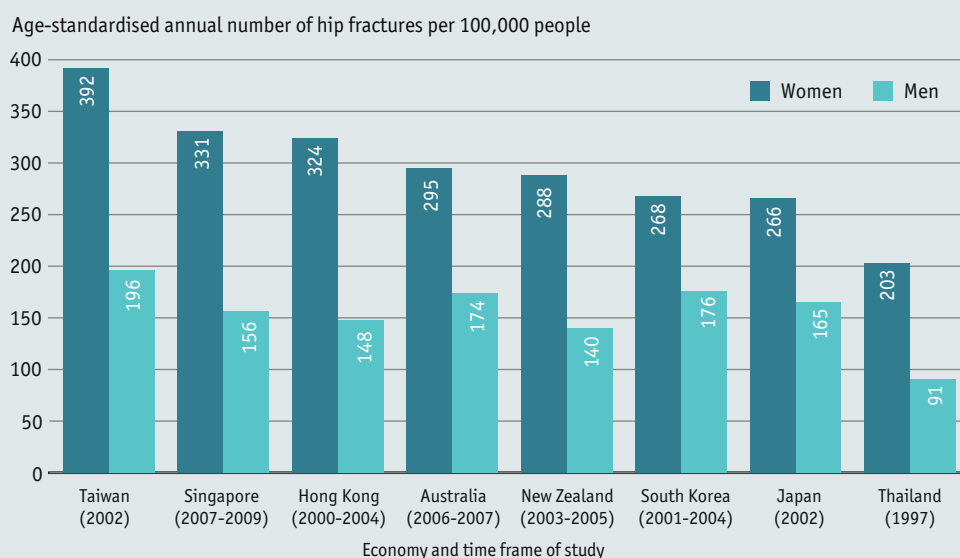


As people age, bone of lower mineral density often forms in place of the original, for various reasons, with peak bone density occurring sometime between the ages of 25 and 30 years old. Even after this point, though, the skeleton is far from static, as the body steadily breaks down and rebuilds small amounts of bone. Although different types of bone remodel at different rates, on average about 10% of the adult skeleton is renewed this way every year.<sup>15</sup>

Yet inevitably everyone's bones slowly lose mineral density over the course of their lifetimes, leading to some deterioration in bone structure. Dr Jiwa, however, points out that "there is a line between decreased bone density and a diagnosis of osteoporosis. A curved back, resulting from multiple vertebral fractures, is not a natural part of ageing and should not occur."



### Chart I. Fractured societies



Source: John Kanis et al, "A systematic review of hip fracture incidence and probability of fracture worldwide", *Osteoporosis International*, 2012; Alice Crisp et al, "Declining incidence of osteoporotic hip fracture in Australia", *Archives of Osteoporosis*, 2012

## An increasingly urgent issue in Asia-Pacific

The burden which fragility fractures and osteoporosis currently impose on Asia-Pacific and its likely future increase both demand urgent attention.

Though not all hip fractures in the elderly are osteoporosis-related, they are often used as a proxy for the disease. In the scorecard economies, hip fracture rates are broadly comparable to those in Europe and North America, meaning that each gender in every study country, except for men in Thailand, already faces a moderate or high risk of fracture compared to equivalent groups elsewhere in the world.<sup>17</sup> A long-term study of 14 cohorts in Western countries found that hip fractures reduced the healthy life expectancy of the entire population over 50 by 2.7%.<sup>18</sup> Given the similarities in hip fracture incidence, the burden in well-off Asia-Pacific is presumably similar.

Meanwhile, fragility fractures at other common sites add to the toll. A recent international review found, for example, that South Korea and Hong Kong had the world's first and third highest age-standardised rates of vertebral fractures, bracketing the US in second place.<sup>19</sup>

This leads to a substantial economic cost, partly because hip fracture treatment often involves lengthy hospitalisation. The following list and table summarise a number of studies looking at this economic cost:

- In 2013 the total cost of treating a single hip fracture ranged between US\$20,000 and US\$32,000 in Australia, Japan and New Zealand.<sup>20</sup>
- In these three countries, the total economic burden from treatment of osteoporosis and its complications was 2% of the annual health spend in each, over different time frames.<sup>21, 22, 23</sup>
- For Japan, this is comparable to that of diabetes and more than half that for heart disease, according to Kensuke Moriawaki of Kobe Pharmaceutical University.

<sup>17</sup> John Kanis et al, "A systematic review of hip fracture incidence and probability of fracture worldwide", *Osteoporosis International*, 2012

<sup>18</sup> Nikos Papadimitriou et al, "Burden of hip fracture using disability-adjusted life-years", *Lancet*, 2017

<sup>19</sup> Ghada Ballane et al, "Worldwide prevalence and incidence of osteoporotic vertebral fractures", *Osteoporosis International*, 2017

<sup>20</sup> Ambrish Mithal and Peter Ebeling, *The Asia-Pacific Regional Audit: Epidemiology, costs & burden of osteoporosis in 2013*, 2013

<sup>21</sup> Jennifer Watts et al, *Osteoporosis costing all Australians: A new burden of disease analysis – 2012 to 2022*, 2012; "Failure to prevent fractures costing all states and territories: Osteoporosis Australia Report", Osteoporosis Australia press release, 27 June 2017

<sup>22</sup> Paul Brown et al, "Current and Future Economic Burden of Osteoporosis in New Zealand", *Applied Health Economics and Health Policy*, 2011

<sup>23</sup> EIU calculations based on spending data in "Health expenditure and financing"; OECD Stat database

**Table II. Shelling out**

Economy	Direct hospital costs per hip fracture as a % of total (private and public) annual healthcare spend per person
Japan	666
Thailand	540
Hong Kong	499
New Zealand	474
Australia	356
Singapore	332
Taiwan	235
South Korea	165

Sources: Economist Intelligence Unit data and calculations; International Osteoporosis Foundation; *Value in Health Regional Issues*

Yet in too many countries, health authorities seem unaware of these figures because of the extensive analysis required to derive them. Kerrie Sanders, a professor at Australian Catholic University's Institute for Health & Ageing believes that "policy makers and politicians need to be more aware of the substantial health budget that is being spent on management of fractures."

### ***A growing threat***

The biggest concern is how this already substantial human and economic burden looks set to increase. As Peter Ebeling of Osteoporosis Australia puts it, "The epicentre of hip fractures will be in Asia by 2050 unless we do something now." Estimates are that by 2050, half of the world's hip fractures will occur in the region, up from one-sixth in 1990, adds Dr Cooper.

Certain controllable risk factors are common and addressing them could help. For example, most populations covered in the report have worrying vitamin D deficiencies.<sup>24</sup> Yet the main driver will simply be ageing. As chart II shows, the percentage of populations over 50—the age at which osteoporosis risk starts to grow from relatively low to substantial—has been increasing in all the study economies. In economies outside Oceania, the rise has been particularly rapid, according to UN data, growing from an average of just 19% in 1990 to a projected 49% by 2035. This shift is occurring at a historically torrid pace. As Hyoungh Moo Park of South Korea's Chung Ang University points out: "It took France 70 years to go from an ageing society to an aged one. It will take South Korea just 17."

Dr Cooper notes that in North America, Europe, Australia and New Zealand, age-standardised hip fracture rates began to decline as far back as the 1980s. This would be consistent with older people also being generally healthier (and in turn living longer). Yet among the other study economies, only Hong Kong's and Taiwan's overall age-standardised rates have shown slow declines in the first years of this century.<sup>25</sup> Signs of this are also occurring in Singapore. Those in their 70s in Japan are also seeing improvement although that country, along with South Korea and Thailand, is still experiencing an overall increase in the age-standardised rate.<sup>26</sup> These places face a double-whammy of rising hip fracture rates and rapid population ageing. Yet even places with declining age-standardised rates face a substantial challenge: according to Sze-Hung Wong, a Hong Kong orthopaedic surgeon, "Although the age-adjusted incidence of hip fractures has dropped slightly, the ageing population in Hong Kong, as in other countries, will make the absolute number shoot up rapidly."

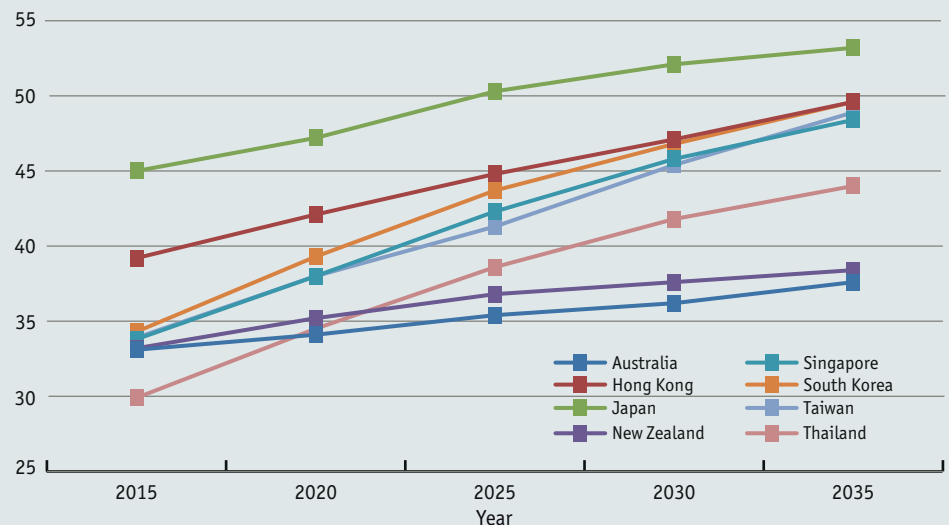
<sup>24</sup> Robin Daly et al, "Prevalence of vitamin D deficiency and its determinants in Australian adults aged 25 years and older", *Clinical Endocrinology*, 2012; N Yoshimura, "Profiles of vitamin D insufficiency and deficiency in Japanese men and women", *Osteoporosis International*, 2013; Xinyan Bi et al, "Prevalence of Vitamin D Deficiency in Singapore", *PLoS One*, 2016; Han Seok Choi, "Vitamin D Status in Korea", *Endocrinology and Metabolism*, 2013; Oranan Siwamogsatham et al, "Vitamin D deficiency in Thailand", *Journal of Clinical & Translational Endocrinology*, 2015

<sup>25</sup> Edith Lau, "The epidemiology of osteoporosis in Asia", *IBMS BoneKEy*, 2009; TY Wu et al, "Trends in hip fracture rates in Taiwan: a nationwide study from 1996 to 2010", *Osteoporosis International*, 2017

<sup>26</sup> Hajime Orimo et al, "Hip fracture incidence in Japan: Estimates of new patients in 2012 and 25-year trends", *Osteoporosis International*, 2016; Cyrus Cooper et al, "Secular trends in the incidence of hip and other osteoporotic fractures", *Osteoporosis International*, 2011; Mithal 2013

**Chart II. Grey is the new black**

% of population 50 and older (forecast)



Source: UN Population Division, World Population Prospects 2017

**When I first entered osteoporosis research in 1981, it was seen as a universal accompaniment of ageing, a bit like grey hair.**

*Cyrus Cooper, president, International Osteoporosis Foundation*

### ***Effective intervention is possible***

Although long associated with old age, the current understanding of osteoporosis is relatively new. “When I first entered osteoporosis research in 1981, it was seen as a universal accompaniment of ageing, a bit like grey hair,” says Dr Cooper.

Since the early 1990s, however, healthcare systems have introduced numerous innovations both before and after fractures occur, including the capacity to measure bone density non-invasively, assess fracture risk, give appropriate dietary and lifestyle guidance to maintain skeletal integrity, and draw on a variety of medications to help those most affected, says Dr Cooper. The change is so dramatic he calls it “a triumph of modern medicine”.

The relative novelty of these developments means that, to some extent, best practice is still being worked out. For example, unlike for diabetes and heart disease, “It’s hard to monitor the response to [osteoporosis] treatment,” says Chih-Hsing Wu of Taiwan’s National Cheng Kung University Medical Center. Accordingly, the medical community is determining the best use of so called bone turnover markers, which measure the rate of bone remodelling. Despite progress, the optimal way to employ these remains a work in progress.<sup>27</sup>

Still, recent years have seen the gradual build-up of an evidence base. Dr Cooper points to a recently completed trial in the UK which was the first to show that screening and active treatment of osteoporosis patients could reduce the number of hip fractures, in this case by 28% over a five-year period.<sup>28</sup>

### ***Addressing the entire care pathway***

Existing evidence already points to a range of valuable interventions. They begin, explains Dr Cooper, with a population health strategy which includes appropriate diet, exercise, smoking avoidance and other positive

<sup>27</sup> Richard Eastell and Pawel Szulc, “Use of bone turnover markers in postmenopausal osteoporosis”, *The Lancet Diabetes and Endocrinology*, 2017

<sup>28</sup> Lee Shepstone, “The SCOOP study – Do we now have a rationale to screen for osteoporosis?” slide presentation, UK National Osteoporosis Conference, November 2016, <https://www.slideshare.net/NationalOsteoporosisSociety/osteoporosis-2016-the-scoop-study-do-we-now-have-a-rationale-to-screen-for-osteoporosis-lee-shepstone-osteo2016>

lifestyle choices. This should not merely be for the over 50s: maximising bone mass through healthy living is also important for the young. In many ways, this overlaps with prevention strategies for other NCDs, but it has specific content as well, including promotion of vitamin D, and, especially as people age, fall prevention programmes. For those with low BMD, medication can also help increase bone density and reduce the chance of fracture.

The range of interventions makes clear that addressing osteoporosis requires a multi-faceted but consistent and co-ordinated approach. At a minimum, the disease itself falls where several medical specialties overlap: orthopaedic surgeons are key players after fractures, but patients also need endocrinologists to address the underlying condition and geriatricians or gerontologists who understand the complex specific healthcare needs of older people who frequently have more than one chronic disease.

The precise form these interventions should take is still being worked out, but two forms deserve mention. The first is the FLS. Although particular arrangements vary, typical are those in Singapore, whose participating hospitals appoint “clinical champions” for each patient appearing with low-stress fractures. These specialists coordinate care, which includes screening for osteoporosis and, if the disease is found, appropriate education—both about the condition and fall prevention—medication, an exercise programme, and patient follow-up, including further tests. Checks of adherence to medication and exercise regimens continue for two years. FLSs have shown marked, cost-effective benefits in reducing fractures worldwide.<sup>29</sup> In Singapore’s case, hip re-fractures dropped by more than half after the programme’s introduction.<sup>30</sup> Indeed, the results are such that Ambrish Mithal of Medanta, the Medicity, a specialty hospital in Gurgaon, India, believes “it is now really medical negligence not to provide a secondary prevention strategy to those we are treating for fractures.”

FLSs are hospital-level interventions. Coordination of efforts through national multi-sector alliances also holds great promise, especially as “single agencies can’t successfully achieve integrated service delivery, at scale, in a consistent and reliable way, unless they work in partnership,” says Gill Hall, the falls prevention lead for New Zealand’s Accident Compensation Corporation (ACC) (see box II).

Taiwan is a prominent example of a coordinated approach, having implemented many FLSs in a short time. These have been supplemented by educational workshops for healthcare professionals, the application of international best practice, public-awareness campaigns and various international collaborations, including with the IOF.<sup>31</sup> Much of this is buttressed by adequate visibility around the disease in the medical system: “We have the data to create effective osteoporosis policy,” says Dr Wu.

### ***The holistic picture***

The way osteoporosis exacts its physical toll through fractures, especially fall-related ones, means it must be understood as part of a wider problem. Toshio Matsumoto of Japan’s University of Tokushima explains: “The more there is progress in the treatment of osteoporosis, the more problems from other disorders become apparent.” The latter include other conditions of ageing such as dementia and sarcopenia (a loss of muscle mass and function) or other diseases which may be related biologically or contribute to the risk of falling.<sup>32</sup>

The common overlap of these conditions is described by the term “frailty”, a degeneration of physical, psychological and social functioning. In recent decades researchers have tried to give some quantifiable measurement to states of frailty, and osteoporosis’s role within this complex of risk factors and diseases

<sup>29</sup> Samuel Walters et al, “Fracture liaison services: improving outcomes for patients with osteoporosis”, *Clinical Interventions in Ageing*, 2017

<sup>30</sup> International Osteoporosis Federation, *Capture the Fracture: A Global Campaign to Break the Fragility Fracture Cycle*, 2012

<sup>31</sup> “Taiwanese Osteoporosis Association reports successes in secondary fracture prevention”, International Osteoporosis Foundation, 1 May 2017, <https://www.iofbonehealth.org/news/taiwanese-osteoporosis-association-reports-successes-secondary-fracture-prevention>

<sup>32</sup> Shigeyuki Muraki et al, “Prevalence of Falls and the Association With Knee Osteoarthritis and Lumbar Spondylosis As Well As Knee and Lower Back Pain in Japanese Men and Women”, *Arthritis Care & Research*, 2011

has become generally accepted.<sup>33</sup> The implication, says Tang Ching Lau of Singapore's National University Hospital, is that "you cannot look at osteoporosis in isolation. You have to manage the patient as a whole." Interactions between drugs for different diseases prescribed by different specialists may cause dizziness, for example, thereby increasing the risk of a fall.

Dr Matsumoto explains that the aim of osteoporosis treatment is "to reduce the period of dependency, where people are not able to walk or move by themselves". This requires a holistic approach, where things as simple as advice on reducing the likelihood of tripping inside the home have a place alongside medical interventions to bolster BMD.

### *Too little, too late?*

Unfortunately, such holistic efforts remain the exception and a huge treatment gap persists, even for the most basic interventions. In South Korea, for example, a 2012 study estimated that just 13% of those with osteoporosis were receiving treatment.<sup>34</sup> Even after a fracture, the picture is little improved. Thawee Songpatanasilp, an orthopaedic surgeon who specialises in osteoporosis, explains that in Thailand, "Most orthopaedic surgeons treat only the fracture and send people home. They do not even send people to endocrinologists." In more developed economies the situation is still dire. In Australia, fewer than 20% of those who experience fragility fractures receive treatment for osteoporosis in order to prevent another such event, says Dr Ebeling. Hong Kong and Japan have similar figures.<sup>35</sup>

More broadly, a 2013 study of post-menopausal women who had gone to hospital with a fragility fracture covered facilities in seven Asian economies, including Hong Kong, Taiwan, Singapore, South Korea and Thailand. Overall, it found only a third with fractures received prescription medication for osteoporosis.<sup>36</sup>

In this lack of attention to osteoporosis, high-income Asia-Pacific economies differ little from the rest of the developed world. With a potentially huge rise in the number of fractures, this state of affairs is ultimately unsustainable. As Mr Mitchell notes, failure to act will mean "unmitigated disaster".

This result is unnecessary, given the progress in understanding the disease and development of interventions against it over the past two decades. Dr Mithal explains that for an effective public health intervention, a disease "should be common; it should have serious consequences; and there should be something you can do about it. Osteoporosis has all three." Dr Cooper agrees: "We know how to assess risk, we know how to treat, and we know how to make osteoporosis something that is a rarity."

<sup>33</sup> Guowei Li et al, "An overview of osteoporosis and frailty in the elderly", *BMC Musculoskeletal Disorders*, 2017

<sup>34</sup> Yong Jun Choi et al, "The Prevalence of Osteoporosis in Korean Adults Aged 50 Years or Older and the Higher Diagnosis Rates in Women Who Were Beneficiaries of a National Screening Program", *Journal of Bone and Mineral Research*, 2012

<sup>35</sup> KS Leung et al, "How well are we managing fragility hip fractures? A narrative report on the review with the attempt to set up a Fragility Fracture Registry in Hong Kong", *Hong Kong Medical Journal*, 2017; Masayuki Iki, "「骨粗鬆症の予防と治療ガイドライン2011」をめぐって Review 骨粗鬆症の疫学" [Review article "Aim of the Guidelines for the Prevention and Treatment of Osteoporosis (2011 edition)", "Epidemiology of osteoporosis in Japan"], *Clinical Calcium*, 2012

<sup>36</sup> Annie Kung et al, "Factors influencing diagnosis and treatment of osteoporosis after a fragility fracture among postmenopausal women in Asian countries", *BMC Women's Health*, 2013

## BOX II. NEW ZEALAND'S MULTI-STAKEHOLDER ALLIANCE

In New Zealand, 2011 marked a change in efforts to address the intertwined challenges of falls, fractures and osteoporosis. That year, says Mr Mitchell, saw “the most fantastic alignment of the planets” whereby government agencies, healthcare profession organisations and NGOs formed an alliance where each would use its strengths to collectively address relevant issues of care and prevention in a coherent way.

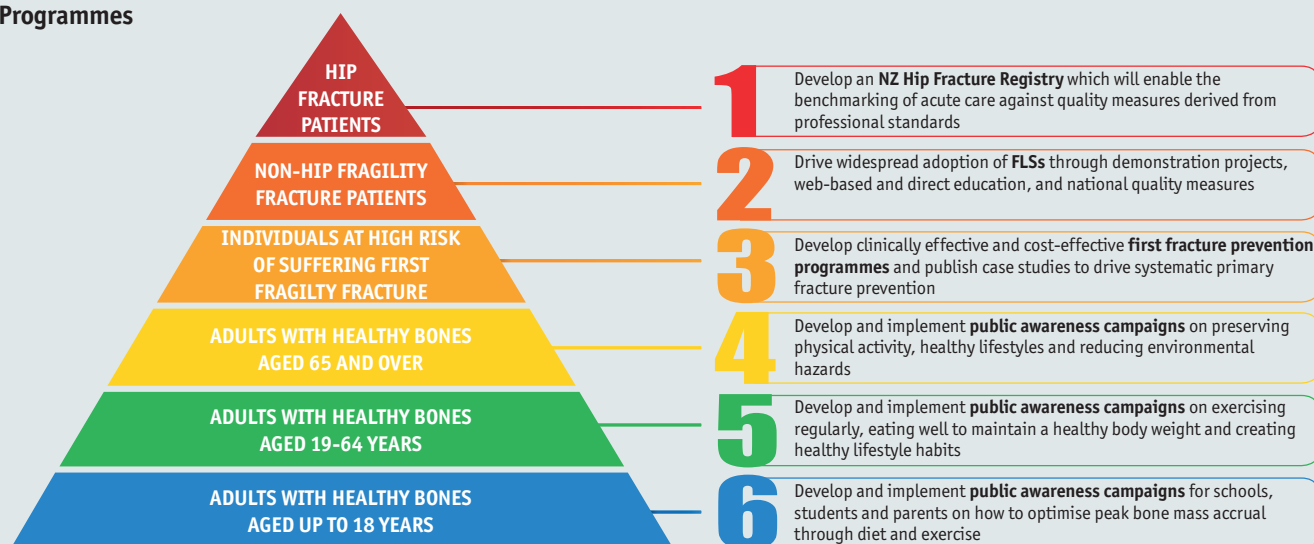
The strategy pursued by these actors, Mr Mitchell explains, stemmed from Osteoporosis New Zealand’s 2012 strategy document, *Bone Care 2020*. This used a pyramid to conceptualise the interventions needed at different points (see diagram), from public health education for the young to FLSs for those who had already broken a bone.

NZ\$30.5m (\$22.2m) investment in various aspects of falls and fracture prevention and care by different stakeholders constitutes “our largest ever injury prevention investment”, according to Ms Hall.

More important is that it is a joint enterprise of engaged stakeholders. “We’re proud of being part of this collective of health system partners, central agencies and NGOs,” she says. “It has become quite a deliberate thing to talk about it as an alliance.”

The organising principle of the alliance’s activities is the needs of the individual patient. Ms Hall describes the invention of a hypothetical elderly osteoporosis patient named Muriel as a model which focuses

### Programmes



Source: Osteoporosis New Zealand, *Strategic Plan 2017-2020*, 2016

Early efforts focussed on the top of the pyramid, where the need is most immediate. The results include a range of mutually reinforcing efforts, including the creation of a hip fracture registry, the rapid expansion of FLSs to most of the country and a national fall prevention scheme.

A key factor in the ongoing success of these efforts is the nature of the cooperation. Government engagement is essential, and the ACC’s

attention on the issue. “It’s been quite a breakthrough using a persona that we can all connect to and all bring our perspectives to,” she says.

This cooperation is now being formalised further and given a national identity under the Live Stronger for Longer initiative, which Ms Hall refers to as a “unifying brand” so that healthcare consumers and service providers will have a more coherent idea of the interrelated efforts needed for falls and fracture prevention.



## THE ASIA-PACIFIC FRACTURE AND OSTEOPOROSIS SCORECARD

To compare the current fracture and osteoporosis burden facing the study economies, and how they are coping across the wide range of areas for intervention, The Economist Intelligence Unit has created a unique tool, the Asia-Pacific fracture and osteoporosis scorecard. Its four domains are:

Domain	Selected indicators
Burden	<ul style="list-style-type: none"> <li>Fracture rates and associated impact</li> <li>Osteoporosis prevalence</li> <li>How demographic change may increase the challenge in future</li> </ul>
Prevention and policy	<ul style="list-style-type: none"> <li>Existence of education and prevention campaigns</li> <li>Extent of liaison services</li> <li>Quality of fracture data</li> </ul>
Identification	<ul style="list-style-type: none"> <li>Existence of diagnostic risk assessment tools</li> <li>Access to DXA machines, which are used to measure BMD</li> </ul>
Treatment	<ul style="list-style-type: none"> <li>Pharmaceutical and non-pharmaceutical treatments</li> <li>Speed of post-fracture surgery</li> </ul>

For each domain, data were collected on indicators chosen to best reflect the national situation, although availability restricted options. The scorecard data also need to be internationally comparable, which further restricted the studies we could use to populate it. It thus presents the best information available for assessing how the study economies are doing next to their peers, while the individual reports included later are essential for getting a fuller understanding of the situation in each.

For indicators relating to burden, or for which no clear best practice exists, the scorecard simply shows the relevant data. For others, economies received a score of red, amber or green to indicate how well they are performing against benchmarks set based on the project's research. These scores should be compared only with others for the same indicator. The scorecard does not aggregate scores to rank countries either in each domain or overall. See the appendix for a more detailed description of the methodology.

### *Scorecard results and overall impressions*

**Data deficiencies.** The biggest challenge in creating the scorecard has been data gaps: almost all hip fracture data in a form fit for international comparison comes from studies conducted 15 to 20 years ago. Later research in several places has not been standardised around the same population and therefore cannot be used for comparison. Neither Thailand nor Singapore have credible figures on osteoporosis prevalence, and those used for New Zealand report the diagnosis rate rather than estimating actual prevalence.

Different places have found ways to fill the gaps. A joint Australia-New Zealand hip fracture registry is now up and running, and Hong Kong is setting one up. Elsewhere, as in Taiwan and South Korea, researchers can draw on extensive databases from universal national health systems and periodic national health status surveys for accurate macro-level pictures.

Which holes can be filled depends on the nature of the data. For example, although the WHO calls osteoporosis a disease, it is not included as one in the organisation's Global Burden of Disease study, which

# Demystifying ageing: Lifting the burden of fragility fractures and osteoporosis in Asia-Pacific

Scorecard		Economies							
Indicator	Description	Taiwan	Singapore	Hong Kong	Australia	New Zealand	South Korea	Japan	Thailand
Hip fracture rate	Age-standardised annual number of hip fractures in women per 100,000 population (non-scored indicator) Age-standardised annual number of hip fractures in men per 100,000 population (non-scored indicator)	392	331	324	295	288	268	266	203
Osteoporosis prevalence	Estimated osteoporosis prevalence 50 years and over (male, female) (non-scored indicator)*	196	156	148	174	140	176	165	91
Ageing population	Proportion of the population aged 50 years and over in 2015 (non-scored indicator) Proportion of the population estimated to be aged 50 years and over in 2035 (non-scored indicator) Estimated change in proportion of over 50s from 2015 to 2035 (percentage point increase) (non-scored indicator)	24% men 38% women	No up-to-date data	7.2% men 36.8% women	6% men 23% women	2% men <sup>#</sup> 10% women <sup>†</sup>	7% men 38% women	4% men 38% women	No up-to-date data
Costs	Direct medical costs for patients per hip fracture (US\$) (non-scored indicator) Direct hospital costs per hip fracture as a percentage of total (private and public) annual healthcare spend per person (non-scored indicator)	\$3,242.00 235%	\$8,380.00 332%	\$10,782.00 499%	\$21,824.00 356%	\$22,322.00 474%	\$3,088.00 165%	\$27,599.00 666%	\$2,064.00 540%
Public awareness	Public awareness raising about fractures and osteoporosis through (1) patient disease information or World Osteoporosis Day activities, or (2) both. Neither = 0	1	2	2	2	2	1	1	0
National plans	Is there a (1) national plan for healthy ageing that (2) explicitly addresses bone health/osteoporosis? Neither = 0	2	2	1	2	1	0	1	0
Primary prevention	Do national treatment guidelines recommend primary falls prevention/good bone health (diet, exercise, etc)? Yes/No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Secondary prevention	What percentage of hospitals offer fracture liaison services to prevent secondary fractures? (2) > 50% (1) 1-50% (0) not implemented	1 <sup>+</sup>	2	1	1	2	0	1	0
Registry data	Are fractures data collected through a fractures registry or national databases that can support audits? Registry, registry in development, national data, none	National data	None	Registry in development	Registry	Registry	National data	Registry	None
Advocacy/patient voice	Are there (1) NGOs representing osteoporosis and (2) do they provide patient advocacy or representation? No NGOs = 0	1	1	1	2	2	1	2	2
Risk assessment	Do national treatment guidelines recommend that risk assessment tools are used to assess fracture risk in asymptomatic and symptomatic patients, eg FRAX, Ofracture? Yes/No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Diagnosis requires DXA	Does the treatment pathway in national treatment guidelines specify that a DXA scan is required to access osteoporosis treatment? (non-scored indicator)	Yes	Yes	Yes	No	No <sup>†</sup>	Yes	Yes	No
DXA scanning accessibility	Are DXA scans reimbursed by public health insurance? Yes/No, conditional – eligibility based on risk or after fracture, partial = <100% reimbursement Number of bone density scanning (DXA) machines per million population (non-scored indicator) Approximate waiting times for DXA scans (2) days (1) weeks [≥7 days] (0) months	Yes - conditional	Yes - partial	Yes - conditional	Yes - conditional	Yes - conditional	Yes - conditional	Yes - conditional	Yes - partial
Surgery	Average time that hip fracture patients have to wait for surgery (2) 1-2 days (1) 2-3 days (0) 3 days or more	2	1	0	2	2	2	2	2
Non-pharmaceutical treatment	Do national treatment guidelines recommend non-pharmaceutical treatments (eg diet, exercise, physiotherapy programmes) as part of osteoporosis treatment in clinical practice guidelines? (2) Yes (1) Partial (0) No	2	2	2	2	2	2	2	2 <sup>†</sup>
Pharmaceutical treatment	Which drugs are recommended in treatment guidelines? Drug abbreviations: BPS (bisphosphonates), HRT (hormone replacement therapy), PTH (parathyroid hormone), SERM (selective oestrogen receptor modulator), STER (selective tissue estrogenic activity regulator), TSEC (tissue-selective estrogen complex) (non-scored indicator)	Biologics BPS, HRT, PTH, SERMs, STER, Strontium ranelate	BPS, PTH, SERMs, Strontium ranelate	Biologics BPS, Calcitonin, HRT, PTH, SERMs, Strontium ranelate	Biologics BPS, HRT, PTH, SERMs, STER, Strontium ranelate	Biologics BPS, HRT, PTH, SERMs	Biologics BPS, Calcitonin, PTH, SERM, STER, TSEC	BPS, Calcitonin, HRT, Isoflavonoids, Nandrolone decanoate, PTH, SERMs	Biologics BPS, PTH, SERMs, Strontium ranelate
Patient follow-up	Do national treatment guidelines recommend that (1) patients are followed up and (2) is treatment adherence included in the follow-up process?	2	2	2	1	1	0	2	2

Study economies ordered by current burden, measured using hip fracture rates per 100,000 population (women)  
 Indicators based on national treatment guidelines reflect the recommendations given in those documents, which may not reflect actual practice  
 \* Estimated prevalence data drawn from various sources based on data from different years  
 † Diagnosed cases  
 ‡ 2013 data, number of RLSs has subsequently increased by an order of magnitude but reliable, national data is lacking  
 † Fracture risk can be calculated without BMD if unavailable  
 ‡ Only 53% of hip fracture patients treated surgically, other economies treat ~90% surgically

instead treats it as a risk. Thus, it does not provide death or years lived with disability estimates which might provide useful international comparisons. Osteoporosis is also not called out within the WHO Global Action Plan for the prevention and control of NCDs. Better outcomes data is also necessary for the practice of evidence-based medicine, and information on the economic burden could be a significant help in “[making] osteoporosis sexy for politicians in some way”, says Dr Ebeling.

**Signs of progress.** The scorecard shows that some weapons in the fight against osteoporosis have already spread widely. Every study economy, for example, has risk assessment tools and clinical guidelines to promote falls prevention and good bone health, though they are inevitably uneven. Dr Mithal notes that the extent of efforts against the disease typically “is directly linked to economic growth”. Yet even Thailand, the scorecard’s only middle-income country, shows indications of improvement, however limited.

**Lack of a comprehensive approach:** One striking pattern across the study economies is that of progress in certain areas—sometimes substantial—mixed with ongoing deficiencies. South Korea has strong data but weak FLS roll-out, while the opposite is true of Singapore (on both metrics). Japan, meanwhile, while generous regarding access to the latest medications, still suffers from lengthy wait times for post-fracture hip surgery, a situation which has not improved in recent years.<sup>37</sup>

These seemingly haphazard deficiencies reflect the need for some kind of holistic approach, akin to what many countries have established for cancer. The closest, and only, effort resembling this in Asia-Pacific is the Live Stronger for Longer coalition in New Zealand, which itself was based on a successful model in the UK (see box in introduction).

<sup>37</sup> Hiroshi Hagino, “Survey of hip fractures in Japan: Recent trends in prevalence and treatment”, *Journal of Orthopaedic Science*, 2017

# AUSTRALIA

Indicator	Description	Australia
Hip fracture rate	Age-standardised annual number of hip fractures in women per 100,000 population	295
	Age-standardised annual number of hip fractures in men per 100,000 population	174
Osteoporosis prevalence	Estimated osteoporosis prevalence 50 years and over (male, female)	6% men 23% women
Ageing population	Proportion of the population aged 50 years and over in 2015	33%
	Proportion of the population estimated to be aged 50 years and over in 2035	38%
	Estimated change in proportion of over 50s from 2015 to 2035 (percentage point increase)	↑ 5%
Costs	Direct medical costs for patients per hip fracture (US\$)	\$21,824.00
	Direct hospital costs per hip fracture as a percentage of total (private and public) annual healthcare spend per person	356%

## Burden: the high costs of relative moderation

Australia has one of the lowest osteoporosis burdens of all scorecard economies: among those over 50, 23% of women and 6% of men have the condition. Although the figure for women dates to the 1990s, smaller, later studies, while not comparable overall, have shown similar age-specific rates.<sup>38</sup>

Although Australia's age-standardised hip fracture rates are in the upper half of scorecard economies, they declined by 20% for women and 13% for men between 1997 and 2007.<sup>39</sup> Rates for fragility fractures to the wrist have also dropped.<sup>40</sup> The proportion of the population over 50, while similar to that elsewhere, is also projected to rise more slowly.

Yet earlier growth in Australia's older population saw actual number of hip fractures among those over 50 increase by 22% in men and 7% in women between 1997 and 2007.<sup>41</sup> The future likely holds more of the same: the raw number of Australians over 50 is still expected to rise by 41% between 2015 and 2035.

This leads to high economic burden. Recent analyses by Osteoporosis Australia put the country's annual direct expense at A\$3.1bn (\$2.5bn) in 2017, up from A\$2.8bn in 2012.<sup>42</sup> As Dr Ebeling puts it, the disease is "a huge challenge here, and very expensive".

## Strengths: well-equipped healthcare and well-funded treatments

Australia performs well in the scorecard's identification and treatment sections. A good number of DXA machines with little waiting to be scanned (in urban areas at least), a new hip registry in co-operation with New Zealand, rapid hip replacement surgery when necessary, and detailed, evidence-based diagnosis and treatment guidelines all indicate a health system and clinicians capable of meeting osteoporosis's challenge.<sup>43</sup> Nor are out-of-pocket costs a pressing concern: DXA scans are largely reimbursed by the government, notes Dr Ebeling, and many medications are fully paid for as first-line treatments.

<sup>38</sup> Australian Institute of Health and Welfare 2014

<sup>39</sup> Alice Crips et al, "Declining incidence of osteoporotic hip fracture in Australia", *Archives of Osteoporosis*, 2012

<sup>40</sup> Cooper 2011

<sup>41</sup> Australian Institute of Health and Welfare, "The problem of osteoporotic hip fracture in Australia", Bulletin 76, 2010

<sup>42</sup> "Failure to prevent fractures costing all states and territories: Osteoporosis Australia Report", Osteoporosis Australia press release, 27 June 2017 (for state level reports, see: "New state and territory reports released", Osteoporosis Australia web page, 2017, <https://www.osteoporosis.org.au/burdenofdisease>); Watts 2012

<sup>43</sup> Royal Australian College of General Practitioners, *Osteoporosis prevention, diagnosis and management in postmenopausal women and men over 50 years of age*, 2nd edition, 2017

***Weaknesses: lack of integration and interest***

Yet coordination remains a challenge. In around 80% of fragility fracture cases, for example, patients are not assessed for osteoporosis.<sup>44</sup> This likely contributes to high rates of re-fracture: in Western Australia from 2002–2011, 38% of fragility fracture admissions were for re-fractures, and the probability of being admitted for a re-fracture within six months of an initial breakage was 20% for women and 17% for men.<sup>45</sup> Less than a third of patients who come to a general practitioner (GP) with a fragility fracture receive pharmacological treatment.<sup>46</sup>

FLSs could help. However, Dr Ebeling notes that Australia's constitutional division of powers creates an apparent mismatch of economic costs and benefits, which makes such programmes of limited interest to federal policymakers. At the state level, "It depends on the individual health minister and their department," he says. Patchy official interest explains Australia's highly uneven FLS distribution. The health ministry in New South Wales conducted a pilot with very positive results—an approximately 40% drop in major re-fractures<sup>47</sup>—and began a wider rollout in state hospitals. This remains the only place in the country with clear success in FLS (see map).

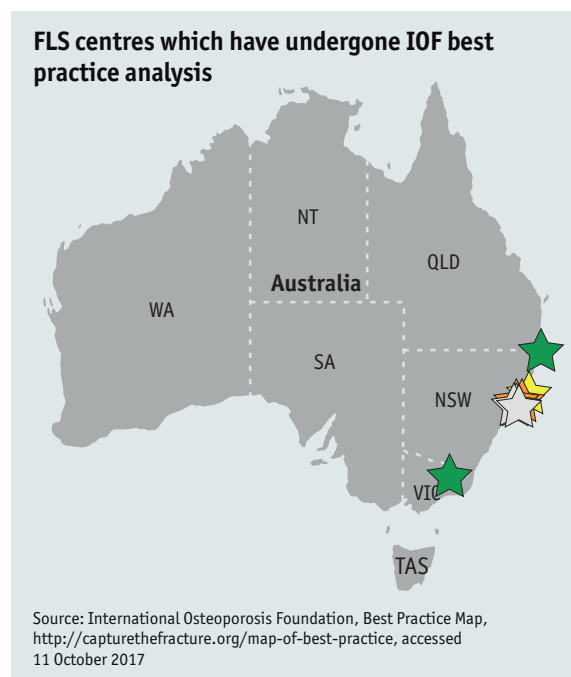
Australian NGOs, as a first step to address the effects of healthcare fragmentation, are trying to overcome it in their own ranks. They have recently formed the SOS Fracture Alliance, which aims to be a so-called "national peak body" in order to allow advocates to have a unified voice at the federal level. Ultimately, however, as Ms Sanders notes, "Policy makers and politicians are interested in what is of interest to the people in their electorates." She hopes that as the population ages further, health issues such as osteoporosis will gain a higher public profile. For the moment, though, public awareness remains poor: "Many people, for example, still believe that if they grew up having a lot of milk and cheese, they are not at risk of fracture in their later life," she says.

<sup>44</sup> Frances Milat and Peter R Ebeling, "Osteoporosis treatment: a missed opportunity", *Medical Journal of Australia*, 2016

<sup>45</sup> Andrew Briggs et al, "Hospitalisations, admission costs and re-fracture risk related to osteoporosis in Western Australia are substantial: a 10-year review", *Australian and New Zealand Journal of Public Health*, 2015

<sup>46</sup> Royal Australian College of General Practitioners 2017

<sup>47</sup> A Nakayama et al, "Evidence of effectiveness of a fracture liaison service to reduce the re-fracture rate", *Osteoporosis International*, 2016



## HONG KONG

Indicator	Description	Hong Kong
Hip fracture rate	Age-standardised annual number of hip fractures in women per 100,000 population	324
	Age-standardised annual number of hip fractures in men per 100,000 population	148
Osteoporosis prevalence	Estimated osteoporosis prevalence 50 years and over (male, female)	7.2% men 36.8% women
Ageing population	Proportion of the population aged 50 years and over in 2015	39%
	Proportion of the population estimated to be aged 50 years and over in 2035	50%
	Estimated change in proportion of over 50s from 2015 to 2035 (percentage point increase)	↑ 11%
Costs	Direct medical costs for patients per hip fracture (US\$)	\$10,782.00
	Direct hospital costs per hip fracture as a percentage of total (private and public) annual healthcare spend per person	499%

<sup>48</sup> The Osteoporosis Society of Hong Kong (OSHK), "2013 OSHK Guideline for Clinical Management of Postmenopausal Osteoporosis in Hong Kong", *Hong Kong Medical Journal*, 2013

<sup>49</sup> KC Ho et al, "Increase in prescriptions for osteoporosis and reduction in hip fracture incidence in Hong Kong during 2005-2014", *Hong Kong Medical Journal*, 2016; see also Pui Hing Chau et al, "Trends in hip fracture incidence and mortality in Chinese population from Hong Kong 2001-09", *Age and Ageing*, 2013

<sup>50</sup> Stephanie KK Liu, "Early surgery for Hong Kong Chinese elderly patients with hip fracture reduces short-term and long-term mortality", *Hong Kong Medical Journal*, 2017

<sup>51</sup> Elaine Cheung et al, "A secular increase in BMD in Chinese women", *Journal of Bone and Mineral Metabolism*, 2014

<sup>52</sup> Sue Lo, "Bone health status of postmenopausal Chinese women", *Hong Kong Medical Journal*, 2015; Edith MC Lau et al, "Bone Mineral Density, Anthropometric Indices, and the Prevalence of Osteoporosis in Northern (Beijing) Chinese and Southern (Hong Kong) Chinese Women—The Largest Comparative Study to Date", *Journal of Clinical Densitometry*, 2015

<sup>53</sup> Ho 2016

<sup>54</sup> OSHK 2013

### ***Burden: improving yet still too high***

Hong Kong's age-standardised hip fracture rates are an improvement over the past. After nearly tripling between the mid-1960s and mid-1980s, these numbers levelled off.<sup>48</sup> More recently, between 2005 and 2014, among those 60 and above, the age-adjusted rate dropped 34% for women and 28% for men.<sup>49</sup>

Yet Hong Kong still has a high age-standardised fracture rate by global standards. Raw fracture numbers also continue to soar: in 2011, public sector hospitals, for example, managed 24% more geriatric hip fractures than in 2000.<sup>50</sup>

### ***Strengths: extensive infrastructure***

The declining age-standardised rates reflect better BMD across the older population. A study of two cohorts of women over 50, one recruited in 1995-2000 and the second in 2005-2010, found that the latter had BMDs between 4% and 9% greater depending on the site.<sup>51</sup> The prevalence of osteoporosis itself may even be declining. Research on post-menopausal women from 1995-2002, used in our scorecard because of simultaneous comparable research on men, shows that 37% had the condition. Large, more recent studies, however, put it at around only 26%.<sup>52</sup>

Some of this may be due to Hong Kong's strong health infrastructure. It has, for example, the second most DXA machines per capita on the scorecard, and patients who can afford private doctors can get scans instantly. Meanwhile, the number of prescriptions for a key type of drug issued by public sector hospitals grew more than 800% between 2004 and 2015.<sup>53</sup> Lifestyle factors may also play a role: The Osteoporosis Society of Hong Kong cited several in its 2013 guidelines, though it acknowledged a great deal of uncertainty as to the precise reasons for the positive trends.<sup>54</sup>



### ***Weaknesses: inequitable care***

Hong Kong's system is divided between a high-quality private one—which encompasses a minority of hospitals but about 60% of doctors—and a public system which provides around 90% of all care<sup>55</sup> but is overstretched, experts say. With too few seniors able to afford private care, according to Dr Wong, they must turn to a slow public sector where fewer than 4% of hip fracture patients receive DXA scans within a year of the initial trauma.<sup>56</sup>

Moreover, only 3.5% of hip fragility fracture patients have co-management between a geriatrician and an orthopaedic surgeon, while just 23% leave hospital on bone health medication.<sup>57</sup> Hong Kong also falls behind Korea, Singapore and Taiwan on BMD measurement and secondary prevention prescriptions after a fragility fracture.<sup>58</sup> FLSs, which could provide greater coherence to care, are “being developed”, says Eddie Chow of Tuen Mun Hospital.

Meanwhile, private practice physician Ka-Kui Lee believes that “the government is not ready to spend” what is needed because of the likely cost. Indeed, the government is only in the early stages of establishing a fracture registry, and has hired just three liaison nurses for three hospitals in recent years, according to Dr Wong. He adds that public family medicine doctors have no budget to prescribe osteoporosis medication or even vitamin D.

Patient awareness and education also disappoints. Dr Chow says that typically his younger patients (aged about 50 to 70) are much better informed than older ones. In a recent study, however, 43% of those diagnosed with the disease refused treatment and 26% discontinued it or did not attend follow up, likely through lack of concern, worry about side effects or an unwillingness to bear the economic cost.<sup>59</sup>

Similarly, a recent study of a group of health-conscious, postmenopausal Hong Kong women found that almost half did insufficient exercise and failed to consume enough calcium.<sup>60</sup> Nor are the population's low vitamin D levels likely to change so long as more than 60% of Hong Kong women are averse to sunlight.<sup>61</sup>

<sup>55</sup> EIU, Hong Kong Health Care Report, July 2017

<sup>56</sup> WHA Ho and SH Wong, “Bone Densitometry Service and the Post-fracture Care Gap in Hong Kong: How Bad is the Situation”, *Osteoporosis and Sarcopenia*, 2015

<sup>57</sup> Leung 2017

<sup>58</sup> Annie WC Kung, “Factors influencing diagnosis and treatment of osteoporosis after a fragility fracture among postmenopausal women in Asian countries: a retrospective study”, *BMC Women's Health*, 2013

<sup>59</sup> Lo 2015

<sup>60</sup> Ibid

<sup>61</sup> Annie WC Kung and Ka-Kui Lee, “Knowledge of vitamin D and perceptions and attitudes toward sunlight among Chinese middle-aged and elderly women: a population survey in Hong Kong”, *BMC Public Health*, 2006

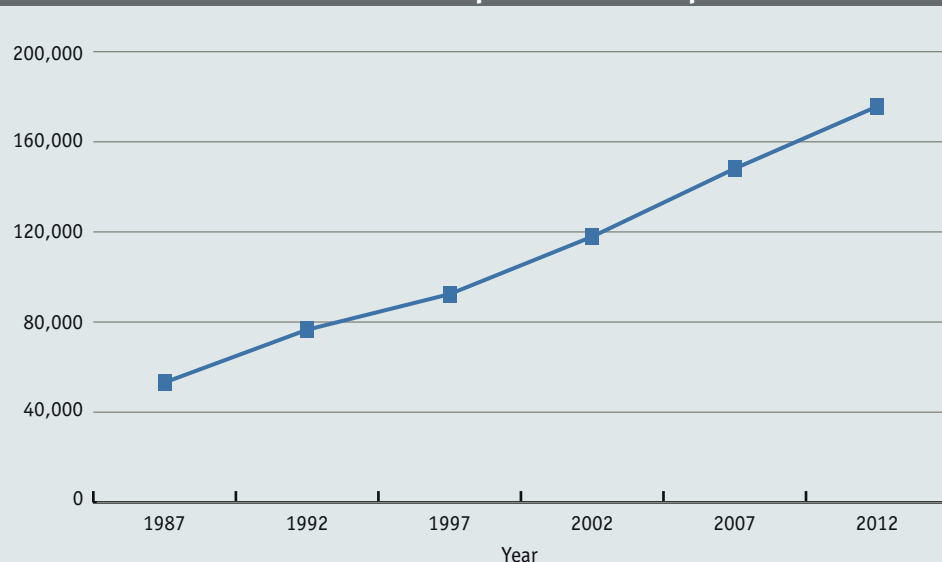
## JAPAN

Indicator	Description	Japan
Hip fracture rate	Age-standardised annual number of hip fractures in women per 100,000 population	266
	Age-standardised annual number of hip fractures in men per 100,000 population	165
Osteoporosis prevalence	Estimated osteoporosis prevalence 50 years and over (male, female)	4% men 38% women
Ageing population	Proportion of the population aged 50 years and over in 2015	45%
	Proportion of the population estimated to be aged 50 years and over in 2035	53%
	Estimated change in proportion of over 50s from 2015 to 2035 (percentage point increase)	↑ 8%
Costs	Direct medical costs for patients per hip fracture (US\$)	\$27,599.00
	Direct hospital costs per hip fracture as a percentage of total (private and public) annual healthcare spend per person	666%

### *Burden: ageing in an already old society*

Although Japan's already sky-high number of over-50s will grow more slowly than in other scorecard economies, Japan will still rank first in 2035. According to UN projections, by then 25% of the population will be 70 or above, up from 19% today.

**Chart III. Estimated total annual hip fractures in Japan**



Source: Hajime Orimo et al, "Hip fracture incidence in Japan: Estimates of new patients in 2012 and 25-year trends", *Osteoporosis International*, 2016

Already, Japan has one of the highest osteoporosis prevalence rates in the scorecard for women and a moderate one for men. Among people aged 65 and over, it has a higher rate of osteoporotic vertebrae fractures than Hong Kong or Thailand.<sup>62</sup> Its ostensibly moderate age-standardised hip fracture scorecard rate, based on 2002 data (the most recent available for the international study on which we draw<sup>63</sup>), appears to have risen between 2002 and 2007. From then until 2012, however, growth seems to have moderated and potentially reversed among people in their 70s.<sup>64</sup> The absolute number of fragility hip fractures, though, continues rising.

Japan has the scorecard's highest average cost per hip fracture, both in absolute terms and as a proportion of total (private and public) annual healthcare spend per person. This helps explain the high cost of osteoporosis to society. With rising fracture incidence, the toll can only increase.

### ***Strengths: sufficient tools and openness to innovative ideas***

In our scorecard, Japan is tied for the second highest number of DXA machines, use of which is paid for by the government and for which there is no waiting time. Japan is also the only Asian economy to have a formal screening programme for osteoporosis, which covers women aged 40 to 70.<sup>65</sup> Institutions in Japan have been experimenting with Osteoporosis Liaison Services (OLSs), which go beyond traditional FLSs to include high-risk patients without a previous fracture.<sup>66</sup> Since 2015, the Japan Osteoporosis Society has qualified those trained in coordination of such services as OLS Specialists. Earlier, some hospitals recognised osteoporosis itself as a specialised medical field.<sup>67</sup> Dr Matsumoto notes that global trials of new drugs typically include Japanese participants. For some medications, he says, "Japanese development has become faster than in the US or Europe", and regulatory agencies are open to new drugs.

### ***Weaknesses: low treatment levels***

These innovations, though, have not always worked. In 2005, just 4.6% of the target population participated in screenings.<sup>68</sup> Little is likely to have changed since then, according to Hajime Orimo of the Japan Osteoporosis Foundation, in part because only around half of the local authorities charged with carrying out screening in fact do so. Liaison services are also uncommon, present in only around 5% of Japanese hospitals, Dr Orimo estimates.

Moreover, only an estimated 20% of those with the disease are receiving drugs, largely due to under-diagnosis.<sup>69</sup> Helpfully, of women actually diagnosed with osteoporosis, a majority (65%) do get such treatment, although research has shown that a history of hip fracture does not increase the probability of a diagnosed individual receiving a prescription.<sup>70</sup>

Japan also has relatively long wait times for post-hip fragility fracture operations—on average more than four days.<sup>71</sup> The most common reason is inability to get access to an operating theatre.<sup>72</sup> Despite abundant resources in Japan's medical system, poor allocation often undermines delivery across the board.<sup>73</sup>

<sup>62</sup> A Kwok et al, "Prevalence of vertebral fracture in Asian men and women: Comparison between Hong Kong, Thailand, Indonesia and Japan", *Public Health*, 2012

<sup>63</sup> Kanis 2012

<sup>64</sup> Cooper 2011; Orimo 2016

<sup>65</sup> Elaine YN Cheung et al, "Osteoporosis in East Asia: Current issues in assessment and management", *Osteoporosis and Sarcopenia*, 2016

<sup>66</sup> Atushi Suzuki et al, "Osteoporosis liaison service in Japan", *Clinical Calcium*, 2015

<sup>67</sup> Suzuki 2015; Mithal 2013

<sup>68</sup> Hajime Orimo et al, "Japanese 2011 guidelines for prevention and treatment of osteoporosis – executive summary", *Archives of Osteoporosis*, 2012

<sup>69</sup> Iki 2012

<sup>70</sup> Masayo Sato et al, "Treatment for Osteoporosis among Women in Japan: Associations with Patient Characteristics and Patient-Reported Outcomes in the 2008–2011 Japan National Health and Wellness Surveys", *Journal of Osteoporosis*, 2014

<sup>71</sup> Hagino 2017

<sup>72</sup> Ibid

<sup>73</sup> Nicolaus Henke et al, "Improving Japan's health care system", *McKinsey Quarterly*, 2009

## NEW ZEALAND

Indicator	Description	New Zealand
Hip fracture rate	Age-standardised annual number of hip fractures in women per 100,000 population	288
	Age-standardised annual number of hip fractures in men per 100,000 population	140
Osteoporosis prevalence	Estimated osteoporosis prevalence 50 years and over (male, female)	2% men 10% women
Ageing population	Proportion of the population aged 50 years and over in 2015	33%
	Proportion of the population estimated to be aged 50 years and over in 2035	38%
	Estimated change in proportion of over 50s from 2015 to 2035 (percentage point increase)	↑ 5%
Costs	Direct medical costs for patients per hip fracture (US\$)	\$22,322.00
	Direct hospital costs per hip fracture as a percentage of total (private and public) annual healthcare spend per person	474%

<sup>74</sup> J Fielden et al, "Hip fracture incidence in New Zealand, revisited", *The New Zealand Medical Journal*, 2001

<sup>75</sup> Brown 2011 estimates the 2007 figure as 3,803; Health Quality & Safety Commission New Zealand, "Falls in people aged 50 and over", March 2017 update, <https://www.hqsc.govt.nz/our-programmes/health-quality-evaluation/projects/atlas-of-healthcare-variation/falls/> puts the actual 2015 figure at around 3,600 and says it has not changed significantly since 2011

<sup>76</sup> Australian and New Zealand Hip Fracture Registry, *2017 Annual Report*, 2017

<sup>77</sup> Osteoporosis New Zealand, *Strategic Plan 2017-2020*, 2016

<sup>78</sup> Osteoporosis New Zealand, *Clinical Standards for Fracture Liaison Services in New Zealand*, 2017

<sup>79</sup> Australian and New Zealand Hip Fracture Registry 2017

<sup>80</sup> Nigel Gilchrist et al, "Enhanced hip fracture management: use of statistical methods and dataset to evaluate a fractured neck of femur fast track pathway—pilot study", *The New Zealand Medical Journal*, 2017

<sup>81</sup> Health Quality and Safety Commission, "Reducing Harm from Falls", <https://www.hqsc.govt.nz/our-programmes/reducing-harm-from-falls/>

### ***Burden: increasing clarity on fractures, ongoing murkiness on prevalence***

New Zealand's female age-standardised hip-fracture rate is about the scorecard average, and that for males the second lowest. Moreover, these rates began to decline in the mid-1990s.<sup>74</sup> The proportion of the population aged over 50, while rising, is doing so more slowly than in most other scorecard economies.

However, hospital admissions for hip fractures among those 50 or older showed little change between 2007 and 2015,<sup>75</sup> and the scorecard data are old, going back to 2003, so current age-standardised rates are uncertain. This data deficit should be solved soon: the Australia and New Zealand Hip Fracture Registry (ANZHFR) now receives patient level data from six New Zealand hospitals and facility level data from the other 17 public ones which treat hip fractures. Eventually all are expected to provide patient data.<sup>76</sup>

The best figures for prevalence, used in the scorecard, are from 2007, but these reflect people diagnosed with the condition and are not the result of population-based studies or national health surveys as elsewhere. Given the high level of undiagnosed osteoporosis in most places, and the demographic and lifestyle similarities between Australia and New Zealand, osteoporosis prevalence in the two countries is likely similar.

### ***Strengths: expanding infrastructure with a coherent approach***

Since 2012, New Zealand has created health system tools for combatting osteoporosis and its consequences. ANZHFR is one example. Another is its multiple FLSs, from none in 2011, according to Mr Mitchell, to one expected in every health district by the end of this year.<sup>77</sup> To help standardise quality, a set of clinical standards was published in 2017 and endorsed by 15 professional and stakeholder organisations.<sup>78</sup> Half of the country's hospitals now have hip fracture care pathways that cover the entire acute treatment experience.<sup>79</sup> One district, by experimenting with greater service integration, has taken an average of four days off time in hospital with no adverse clinical effects.<sup>80</sup> Meanwhile, since 2012, a multi-stakeholder national programme has pursued evidence-based approaches to minimize the hazard from falls.<sup>81</sup>

Undergirding these developments is a strong alliance of various key stakeholders—the Live Stronger for Longer Alliance (see box in introduction)—itself also a key strength of New Zealand’s efforts to address fractures and osteoporosis.

### ***Weaknesses: ongoing lack of awareness***

Mr Mitchell notes that efforts so far have intentionally focussed on the higher risk cohorts of society, which have also seen the most progress. The general public, however, remains less engaged. Two studies from 2007 found that even among New Zealand women receiving DXA scans, knowledge of the disease was poor. Even educated women had some knowledge of risk factors but had unrealistically low feelings of susceptibility.<sup>82</sup>

Moreover, despite local health boards’ engagement, Mr Mitchell believes that “There’s an awful lot of [educational] work to be done to support colleagues on the clinical front line.” A 2015 study, for example, found that orthopaedic nurses had an “inadequate” knowledge of the disease, which impeded patient education.<sup>83</sup> Similarly, the ANZHFR reports that in 2016 only 31% of patients received bone protection medicine on discharge after a hip fracture, down from 40% in 2015.<sup>84</sup> Better information for GPs is also “utterly crucial”, adds Mr Mitchell.

<sup>82</sup> SJ Spencer, “Lack of Knowledge of Osteoporosis: A Multi-Centre, Observational Study”, *Scottish Medical Journal*, 2007; Pamela von Hurst and Carol Wham, “Attitudes and knowledge about osteoporosis risk prevention: a survey of New Zealand women”, *Public Health Nutrition*, 2007

<sup>83</sup> Hannelie Fourie, “Exploring New Zealand orthopaedic nurses’ knowledge of osteoporosis”, *Orthopaedic Nursing*, 2015

<sup>84</sup> Australian and New Zealand Hip Fracture Registry 2017

## SINGAPORE

Indicator	Description	Singapore
Hip fracture rate	Age-standardised annual number of hip fractures in women per 100,000 population	331
	Age-standardised annual number of hip fractures in men per 100,000 population	156
Osteoporosis prevalence	Estimated osteoporosis prevalence 50 years and over (male, female)	No up-to-date data
Ageing population	Proportion of the population aged 50 years and over in 2015	34%
	Proportion of the population estimated to be aged 50 years and over in 2035	48%
	Estimated change in proportion of over 50s from 2015 to 2035 (percentage point increase)	↑ 14%
Costs	Direct medical costs for patients per hip fracture (US\$)	\$8,380.00
	Direct hospital costs per hip fracture as a percentage of total (private and public) annual healthcare spend per person	332%

### *Burden: heavy yet unclear*

Singapore has high age-adjusted hip fracture rates. The most recent trend data on these found that, from 1962 to 1998, these figures had increased 1.5-fold for men and over five-fold for women.<sup>85</sup> Although this rapid increase remains oft-cited as the current rate of change, that is almost certainly not the case anymore. By the 1990s the trend had moderated significantly, with the compound annual growth rate among women down to 1.2% from around 5.7% over the previous three decades and among men to 0.7% from about 1.1%.<sup>86</sup>

The similarity of Singapore's and Hong Kong's age-standardised rates in the mid-1990s and 1985, respectively,<sup>87</sup> and their nearly identical levels in our scorecard, also indicate common long-term trajectories for both. Between the 1980s and the time Hong Kong's scorecard data were collected (2000–2004), the city saw age-adjusted hip fracture rates plateau and even begin to decline.<sup>88</sup> Therefore, it is logical to assume that Singapore's should also have done so.

Yet the overall greying of Singapore's population will drive up the absolute number of cases and impose a heavy burden on the healthcare system, says Manju Chandran of Singapore General Hospital. Meanwhile, an after-inflation rise in the cost of hip fracture surgery per patient, by around 30% from 1993 to 2011,<sup>89</sup> will only increase the toll.

### *Strengths: FLS pioneer and engaged authorities*

Singapore boasts the oldest FLS in Asia, dating to 2008, and is one of only three scorecard economies where FLS population coverage goes beyond minimal.<sup>90</sup> The Osteoporosis Patient Targeted and Integrated Management for Active Living (OPTIMAL) programme has pushed up rates of diagnosis, treatment and referral for DXA scans, and led to higher compliance and adherence rates to medications compared to worldwide figures that report poor compliance, says Dr Chandran. OPTIMAL's better pick up, diagnostic and treatment compliance rates in patients are similar to those reported by successful FLSs elsewhere, she adds. In addition, according to a 2012 audit, OPTIMAL patients who had participated in the programme for two

<sup>85</sup> Leonard Koh et al, "Hip Fracture Incidence Rates in Singapore 1991–1998", *Osteoporosis International*, 2001

<sup>86</sup> EIU calculations based on data from Koh 2001

<sup>87</sup> Koh 2001; Edith MC Lau, "The Epidemiology of Hip Fracture in Asia: An Update", *Osteoporosis International*, 1996; both the Singapore and Hong Kong figures were standardised to the US population and are therefore comparable

<sup>88</sup> Emily MC Lau et al, "Hip fracture in Hong Kong over the last decade – a comparison with the UK", *Journal of Public Health Medicine*, 1999; Chau 2013; a greater drop in rates happened after the collection date of the scorecard data (Ho 2016)

<sup>89</sup> Lester Teong Jin Tan et al, "Inpatient cost for hip fracture patients managed with an orthogeriatric care model in Singapore", *Singapore Medical Journal*, 2017

<sup>90</sup> Mithal 2013



years saw increases in BMD at the spine and hip; hip re-fracture rates among participants were also lower for this group than for a historical control.<sup>91</sup>

Dr Lau commends the government for funding programmes such as OPTIMAL for more than a decade. The government has also taken steps to reduce out-of-pocket costs: in 2015 it allowed individuals to pay for treatments and BMD tests using funds from personal medical accounts (which the country requires all but the lowest earners to maintain); it also subsidises the most expensive drugs to a greater degree than before.<sup>92</sup>

### ***Weaknesses: data, integration, patient awareness***

Singapore suffers from a paucity of osteoporosis data, including figures for prevalence, fractures other than hip or those relating to cost-effectiveness. “Whether what we are doing is bearing fruit is hard to prove,” says Dr Lau, who hopes that a recent Health Ministry decision to move toward centralised medical records will improve matters.

Singapore also faces challenges taking osteoporosis care out of specialist silos and fostering better co-operation between the hospitals where OPTIMAL is largely based and primary care providers, says Dr Lau. Institutions unserved by an FLS often suffer: in 2014 Changi General Hospital provided only 29% of fragility fracture patients with prescriptions for a crucial kind of drug and there was insufficient investigation of secondary causes of osteoporosis. Men were particularly badly served.<sup>93</sup>

Patient awareness is also lacking. Dr Lau says that especially for those who have more than one chronic disease, osteoporosis may not be a high priority. For example, 25% of patients drop out of OPTIMAL before completion; among those who gave a reason, over half said it was because of the time needed or because “osteoporosis is not important”.<sup>94</sup> Finally, while evidence-based at the time, Singapore’s clinical guidelines for osteoporosis are nearly a decade old and could stand to be updated.<sup>95</sup>

<sup>91</sup> Manju Chandran et al, “Secondary prevention of osteoporotic fractures—an ‘OPTIMAL’ model of care from Singapore”, *Osteoporosis International*, 2012

<sup>92</sup> Ministry of Health, “Medisave for Chronic Disease Management Programme (CDMP) and vaccinations”, policy announcement, 13 March 2015, [https://www.moh.gov.sg/content/moh\\_web/home/policies-and-issues/elderly\\_healthcare.html](https://www.moh.gov.sg/content/moh_web/home/policies-and-issues/elderly_healthcare.html); Ministry of Health, Agency for Care Effectiveness, “Denosumab for the treatment of postmenopausal women with osteoporosis at high risk of fracture”, Guidance document, 3 May 2017

<sup>93</sup> Linsey Gani et al, “High prevalence of missed opportunities for secondary fracture prevention in a regional general hospital setting in Singapore”, *Archives of Osteoporosis*, 2017

<sup>94</sup> Manju Chandran et al, “Dropping the Ball and Falling Off the Care Wagon. Factors Correlating With Nonadherence to Secondary Fracture Prevention Programs”, *Journal of Clinical Densitometry*, 2016

<sup>95</sup> Matthew Tan, “A Review of the 2008 Singapore Ministry of Health Clinical Practice Guidelines on Osteoporosis and an Update”, *Journal of the ASEAN Federation of Endocrine Societies*, 2012

## SOUTH KOREA

Indicator	Description	South Korea
Hip fracture rate	Age-standardised annual number of hip fractures in women per 100,000 population	268
	Age-standardised annual number of hip fractures in men per 100,000 population	176
Osteoporosis prevalence	Estimated osteoporosis prevalence 50 years and over (male, female)	7% men 38% women
Ageing population	Proportion of the population aged 50 years and over in 2015	34%
	Proportion of the population estimated to be aged 50 years and over in 2035	50%
	Estimated change in proportion of over 50s from 2015 to 2035 (percentage point increase)	↑ 16%
Costs	Direct medical costs for patients per hip fracture (US\$)	\$3,088.00
	Direct hospital costs per hip fracture as a percentage of total (private and public) annual healthcare spend per person	165%

### ***Burden: demographic disruption***

South Korea's main challenge lies in its demographics: it is one of the fastest ageing economies in our scorecard and the hip fracture rate for men is one of the highest in the survey. That for women is currently more subdued in relative terms—it ranks only sixth out of eight. Nevertheless, the hip fracture rate among the over 50s is rising for both genders, and more quickly among women. Increases are also occurring for breakages of the spine and wrist.<sup>96</sup>

### ***Strengths: data and technology***

South Korea's National Health Insurance Service (NHIS) provides universal care and records almost every diagnosis and medical intervention that occurs. This has allowed for publication of numerous studies under the Korean Nationwide-database Osteoporosis Study project.<sup>97</sup> The Korea National Health and Nutrition Examination Survey, held roughly every three years, included BMD measurements in 2008 and 2011, allowing research into the actual, as opposed to diagnosed, extent of the disease.<sup>98</sup> Yong-Chan Ha, an orthopaedic surgeon and editor-in-chief of the *Journal of Bone Metabolism*, believes professionals have the research data needed to study the disease; indeed, the information is so robust that researchers can delve into topics not considered elsewhere. For example, one study found lower rates of osteoporosis prevalence among post-menopausal women with large social networks, but only if the relationships within them were close.<sup>99</sup>

In addition to good data, the health system brings important weapons to the fight. South Korea has the highest number of DXA machines per capita of any scorecard economy. Scans are free under the public health system—any woman over 65 and man over 70 can have one without a doctor's recommendation, according to Dr Park, and waiting times are short. Other relevant tests, such as for bone turnover rates or vitamin D levels, are also easily available. Last year, those with osteopenia received treatment coverage in certain circumstances for the first time, Dr Ha notes.

<sup>96</sup> Yong-Chan Ha et al, "Current trends and future projections of hip fracture in South Korea using nationwide claims data", *Osteoporosis International*, 2016; Tae-Young Kim et al, "Trends of Incidence, Mortality, and Future Projection of Spinal Fractures in Korea Using Nationwide Claims Data", *Journal of Korean Medical Science*, 2016; Gi-Doo Kwon et al, "Incidence and Mortality after Distal Radius Fractures in Adults Aged 50 Years and Older in Korea", *Journal of Korean Medical Science*, 2016

<sup>97</sup> See, for example, Young-Kyun Lee et al, "Epidemiology of Osteoporosis and Osteoporotic Fractures in South Korea", *Endocrinology and Metabolism*, 2013

<sup>98</sup> See, for example, Park 2014

<sup>99</sup> Seungwon Lee et al, "Contingent association between the size of the social support network and osteoporosis among Korean elderly women", *PLoS One*, 2017

### ***Weaknesses: slow action and gaps in understanding***

Policymakers, however, are less engaged. Dr Ha reports that the government is concerned about the condition, but less so than about other major NCDs. This has implications for what gets treated under the NHIS, which has expanded slowly yet recently become more generous. Until 2011, medication for osteoporosis was available only to those who had experienced a fragility fracture or had a t-score of below -3. That year, the NHIS brought its treatment guidelines in line with international norms, basing decisions on a t-score of -2.5. In both cases, however, payment for medication lasted only one year. As of 2015, this expanded to three, where treatment occurred after a fragility fracture. Still, health authorities are still very slow to approve innovative drugs. And though Korea currently lacks an FLS, Dr Ha reports that he has been asked by the government to oversee the creation of a national one, to launch by 2018.

Low public understanding also impedes progress. Indeed, even after diagnosis, lifestyle behaviour change among those who know they have osteoporosis is minimal, suggesting that risk awareness is either poor or not acted on.<sup>100</sup> This compounds the issue of under-diagnosis and under-treatment. Of those found to have osteoporosis through the 2008 National Health Survey, only 38% had previously been aware of their condition, and just 24% were receiving pharmacological treatment.<sup>101</sup> Even a fragility fracture of the hip does not lead to long-term osteoporosis treatment in most cases, with one cohort study finding this occurred in just 23% of cases.<sup>102</sup>

<sup>100</sup> Hyun-Young Shin et al, "Association between the awareness of osteoporosis and the quality of care for bone health among Korean women with osteoporosis", *BMC Musculoskeletal Disorders*, 2016

<sup>101</sup> Kyae Hyung Kim et al, "Prevalence, awareness, and treatment of osteoporosis among Korean women: The Fourth Korea National Health and Nutrition Examination Survey", *Bone*, 2012

<sup>102</sup> Sang-Rim Kim et al, "Undertreatment of Osteoporosis Following Hip Fractures in Jeju Cohort Study", *Journal of Bone Metabolism*, 2014

## TAIWAN

Indicator	Description	Taiwan
Hip fracture rate	Age-standardised annual number of hip fractures in women per 100,000 population	392
	Age-standardised annual number of hip fractures in men per 100,000 population	196
Osteoporosis prevalence*	Estimated osteoporosis prevalence 50 years and over (male, female)	24% men 38% women
Ageing population	Proportion of the population aged 50 years and over in 2015	34%
	Proportion of the population estimated to be aged 50 years and over in 2035	49%
	Estimated change in proportion of over 50s from 2015 to 2035 (percentage point increase)	↑ 15%
Costs	Direct medical costs for patients per hip fracture (US\$)	\$3,242.00
	Direct hospital costs per hip fracture as a percentage of total (private and public) annual healthcare spend per person	235%

<sup>103</sup> Chung-Jung Shao et al, "A nationwide seven-year trend of hip fractures in the elderly population of Taiwan", *Bone*, 2008 (corrected from 2007)

<sup>104</sup> IJ Chen et al, "Nationwide cohort study of hip fractures: time trends in the incidence rates and projections up to 2035", *Osteoporosis International*, 2015; see also Wu 2017, which has a decline in the age-standardised rate of those 55 and older of 17% among women and 11% among men between 2002 and 2010

<sup>105</sup> Taiwanese Osteoporosis Association, 2017台灣成人骨質疏鬆症防治之共識及指引, 2017 [Consensus Guidelines on the Prevention and Treatment of Adult Osteoporosis in Taiwan]

<sup>106</sup> Chen 2015

<sup>107</sup> CH Tsai et al, "A population-based study on trend in incidence of distal radial fractures in adults in Taiwan in 2000-2007", *Osteoporosis International*, 2011

<sup>108</sup> Lin 2011

<sup>109</sup> Li-Kuo Liu, "Association between Frailty, Osteoporosis, Falls and Hip Fractures among Community-Dwelling People Aged 50 Years and Older in Taiwan: Results from I-Lan Longitudinal Ageing Study", *PLoS One*, 2015

<sup>110</sup> "Taiwanese Osteoporosis Association reports successes in secondary fracture prevention", IOF press release, 1 May 2017, <https://www.iofbonehealth.org/news/taiwanese-osteoporosis-association-reports-successes-secondary-fracture-prevention>

### ***Burden: still substantial despite improvement***

Taiwan has the highest age-standardised hip fracture rates in the scorecard for both genders. The figures, though used because they are the most recent internationally comparable ones, came from 2002, at the end of substantial increase over the preceding decade.<sup>103</sup> A later study from 2004-2011 found a drop in the age-standardised rate for both women and men,<sup>104</sup> one which would still put Taiwan near the top of the scorecard, but with rates similar to the other most-affected economies.

Despite this decline, actual fracture numbers increased by an average annual rate of over 9% between 1999 and 2010,<sup>105</sup> largely due to ageing. One analysis projected that, even with the decline in age-standardised rates, hip fractures would increase 2.7-fold between 2010 and 2035.<sup>106</sup> In addition, as of 2007, the age-standardised rate of wrist fractures was still rising.<sup>107</sup>

Osteoporosis prevalence among women over 50 (38%) is, in line with fracture rates, among the scorecard's highest. The men's figure (24%), though, is so elevated as to be problematic, despite its widespread use by government and other stakeholders. Based on a national study, its small number of male participants over 50 may have led to inaccurate results.<sup>108</sup> A later study covering one county found only 8.4% of men over 50 had osteoporosis,<sup>109</sup> a figure more consistent with other scorecard economies (but which was not used in the scorecard because it was not internationally comparable).

### ***Strengths: health system assets and government focus on ageing***

Taiwan has recently seen an increase in its capacity to address osteoporosis, including rapid spread of FLSs, from just two in 2014 to 19 today.<sup>110</sup> The Taiwanese Osteoporosis Association (TOA) 2017 consensus guidelines also include, for the first time, criteria for an effective FLS.

The number of DXA machines has also risen, from around nine per million population in 2013<sup>111</sup> to about 11 today, according to Dr Wu. He adds that over the last decade the TOA and others have trained around 3,000 physicians and technicians in diagnosis of osteoporosis and there are now roughly 400 specialists in the disease.

Taiwan's Health Protection Agency (HPA) has also focussed on the challenge of ageing, says Ying-Wei Wang, HPA director-general. In 2011, the HPA was a major driver in the development of the TOA's first set of clinical guidelines on osteoporosis, and participates in their biennial revision. The HPA is also looking at evidence of cost-effectiveness with a view to including DXA scans for those aged 65 and over in existing regular, free health checks.

Osteoporosis has also been combined into broader state concerns about ageing, which include falls. In 2016, the government launched a ten-year "Long Term Care 2.0" plan. This did not include specific osteoporosis measures, but under it the HPA initiated a programme in which primary healthcare providers conduct survey-based screening for frailty as a step to reduce falls, says Dr Wang. The TOA's 2017 clinical guidelines also include a section on sarcopenia, a sign of a more holistic approach by various stakeholders.<sup>112</sup>

### ***Weaknesses: lack of budget and integration***

Yet restricted funding under Taiwan's national healthcare system hampers these efforts. Dr Wu notes that National Health Insurance reimburses osteoporosis diagnosis and treatment only for those who have experienced a fracture, thus undermining primary prevention. High risk individuals without a previous fracture must pay for BMD tests and, even where these indicate osteoporosis, preventative medication is not covered until a bone is broken. Insurance restrictions were cited by Taiwanese doctors in a survey as a major issue in discouraging use of osteoporosis drugs.<sup>113</sup> The government also does not increase pay for physicians or technicians who have training in DXA technology, reducing the incentive to improve diagnostic skills, says Dr Wu.

Even after fractures, Taiwan continues to face problems organising care around the patient, according to Dr Wu. One study found that nearly 45% of those experiencing an osteoporotic fracture in Taiwan have another within a year.<sup>114</sup>

<sup>111</sup> Mithal 2013

<sup>112</sup> Taiwanese Osteoporosis Association 2017

<sup>113</sup> Jin Hwan Kim et al, "Perception of severe osteoporosis amongst medical doctors in South Korea: Awareness, impact, and treatment", *Osteoporosis and Sarcopenia*, 2016

<sup>114</sup> Peng-Ching Hsiao et al, "Risk Factors and Incidence of Repeat Osteoporotic Fractures Among the Elderly in Taiwan A Population-based Cohort Study", *Medicine*, 2015

## THAILAND

Indicator	Description	Thailand
Hip fracture rate	Age-standardised annual number of hip fractures in women per 100,000 population	203
	Age-standardised annual number of hip fractures in men per 100,000 population	91
Osteoporosis prevalence	Estimated osteoporosis prevalence 50 years and over (male, female)	No up-to-date data
Ageing population	Proportion of the population aged 50 years and over in 2015	30%
	Proportion of the population estimated to be aged 50 years and over in 2035	44%
	Estimated change in proportion of over 50s from 2015 to 2035 (percentage point increase)	↑ 14%
Costs	Direct medical costs for patients per hip fracture (US\$)	\$2,064.00
	Direct hospital costs per hip fracture as a percentage of total (private and public) annual healthcare spend per person	540%

<sup>115</sup> Khunying Limpaphayom et al, "Prevalence of osteopenia and osteoporosis in Thai women", *Menopause*, 2001

<sup>116</sup> Sureerat Saengsuda, "Prevalence of Osteoporosis and Osteopenia in Thai Female Patients at Rajavithi Hospital", *Journal of Health Science*, 2013; Chatlert Pongchaiyakul et al, "Bone mineral density in rural Thai adults living in Khon Kaen province", *Journal of the Medical Association of Thailand*, 2002

<sup>117</sup> Chatlert Pongchaiyakul, "Prevalence of Osteoporosis in Thai Men", *Journal of the Medical Association of Thailand*, 2006

<sup>118</sup> Kanis 2012

<sup>119</sup> Prasit Wongtriratanachai et al, "Increasing Incidence of Hip Fracture in Chiang Mai, Thailand", *Journal of Clinical Densitometry*, 2013

<sup>120</sup> S Phadungkiat, "Incidence of hip fracture in Chiang Mai", *Journal of the Medical Association of Thailand*, 2002

<sup>121</sup> Thawee Songpatanasilp et al, "Thai Osteoporosis Foundation (TOPF) position statements on management of osteoporosis", *Osteoporosis and Sarcopenia*, 2016

<sup>122</sup> Mithal 2013

<sup>123</sup> Available at <http://capturethe fracture.org/map-of-best-practice>

<sup>124</sup> See also, "Vitamin D deficiency in Thailand (editorial)", *Journal of Clinical & Translational Endocrinology*, 2015

### Burden: patchy data raises alarms

Thailand lacks robust osteoporosis prevalence data, but given existing studies and based on reasonable assumptions, it likely faces a problem of similar magnitude to that in other study economies: prevalence among over-50 women likely falls in the scorecard norm of 23% and 38%, and the prevalence among men may even exceed the range of most scorecard economies of 4%–6%.<sup>115,116,117</sup> Although Thailand has the study's lowest hip fracture rate, data indicate that its women still face medium fracture risk in global terms.<sup>118</sup> Moreover, the fracture rate figures are from 1997. Since then, regional studies have shown a 31% rise in fractures between 1997 and 2006.<sup>119</sup> In addition, the 1997 researchers used hospital records to source cases, but not all Thais with fractures go to hospital, especially in rural areas: one study found 22% more cases using community-based data gathering compared to hospital-based.<sup>120</sup>

Looking ahead, the osteoporosis burden will likely intensify. Thailand will experience nearly as rapid an increase in the proportion of its over-50 population as its Asian neighbours, with 44% of residents expected in that group by 2035.

### Strengths: fitful progress

Thailand shows scattered progress in addressing the disease. The Thai Osteoporosis Foundation (TOPF) has issued detailed clinical practice guidelines since 2002, with the latest update in 2016.<sup>121</sup> TOPF president Boonsong Ongphiphadhanakul of Ramathibodi Hospital believes that awareness is increasing, both among healthcare providers and the general public. Dr Songpatanasilp agrees. He adds that medical equipment availability is also growing, with 100 DXA machines country-wide, a doubling of the 50 reported in 2013.<sup>122</sup> Meanwhile, three institutions have established FLSs, all in the capital Bangkok.<sup>123</sup> Looking ahead, notes Dr Ongphiphadhanakul, the government is considering steps to address widespread vitamin D deficiency in the population.<sup>124</sup>



### ***Weaknesses: lack of interest, funding***

Yet the healthcare system is visibly failing to address osteoporosis. Low engagement by policymakers stymies funding across the board; for example, the TOPF guidelines are not widely followed, in part because the health system does not fund them.<sup>125</sup> Despite improved public awareness, notes Dr Ongphiphadhanakul, many “still believe that calcium intake can on its own prevent osteoporosis”. The scorecard may even over-rate Thailand’s performance, as some indicators record the existence of policy or even unofficial guidelines, not their implementation.

The resultant lack of funding has a direct impact on care. As noted above, the number of DXA machines remains limited. Similarly, in Dr Songpatanasilp’s experience, even though Thailand has a universal health system, many patients, especially in rural areas, simply do not get treated because of high out-of-pocket costs. Reimbursement for many drugs is often so limited that patients frequently either have to pay themselves or stop using them.<sup>126</sup> Dr Ongphiphadhanakul believes that “it is still likely that 80%-90% of high risk individuals are not identified or treated.” Deficiencies around hip fractures are also manifest. Only 53% of such breakages lead to surgical interventions. Worse still, one-year mortality rose from 18% in 1999 to 21% in 2007.<sup>127</sup> With the 2017 national budget announcing a drop of around 10% in government spending on its theoretically free, universal healthcare system,<sup>128</sup> immediate improvement appears unlikely.

Finally, a lack of integrated care impedes effective use of the limited resources available; assessment of fracture patients for osteoporosis, let alone follow-up treatment, remains rare.<sup>129</sup> On a bright note, the TOPF will soon initiate Thailand’s first Capture the Fracture program, says Dr Songpatanasilp.

<sup>125</sup> Ibid

<sup>126</sup> Mithal 2013

<sup>127</sup> Ibid; Rathasart Chaysri et al, “Factors Related to Mortality after Osteoporotic Hip Fracture Treatment at Chiang Mai University Hospital, Thailand, during 2006 and 2007”, *Journal of the Medical Association of Thailand*, 2015

<sup>128</sup> The Economist Intelligence Unit, “Thailand: Healthcare industry report”, Q1 2017

<sup>129</sup> The latest, though dated, figures indicate that “only 7% of [hip fracture] patients were diagnosed as [having] osteoporosis”: Chatlert Pongchaiyakul, “Burden of osteoporosis in Thailand”, *International Journal of Rheumatic Diseases*, 2008

## CONCLUSION: A CALL FOR JOINT EFFORT TO ADDRESS A GROWING EPIDEMIC

Fragility fractures and osteoporosis are already serious public health issues in Asia-Pacific, exacting a substantial human and economic cost. If current ageing trends continue, the burden will only increase. It does not have to: the myth of osteoporosis as a normal part of ageing should be consigned to the past.

Efforts to address the issue, however, are typically incomplete in the eight economies covered by this study, with large, ongoing treatment gaps the norm. On the other hand, signs of improvement exist: FLSs, for example, have become widespread in New Zealand, Taiwan and Singapore and knowledge of the disease among non-specialist clinicians, while often still incomplete, has also improved. While each health system has different strengths and weaknesses, a common set of changes can help prepare them for a potential ageing-related rise in osteoporosis.

- **Increase policymaker engagement.** Too often, governments and health system authorities are more focussed on other pressing concerns. Where state actors are more engaged, as in Singapore and New Zealand, progress has been rapid. Elsewhere it often tends to be slow and halting, and national political and constitutional considerations may be factors that considerably impact the ability of coordinated approaches. Governments need to appreciate the challenge they will face.
- **Build concerted coalition efforts around patients and their needs.** Strategies need to be multi-faceted, from primary prevention in early years to medical treatments that do not interfere with treatments for co-morbidities. This range of actions is likely to be best co-ordinated by a multi-stakeholder alliance such as New Zealand's, which involves coalitions of government, healthcare professionals and NGOs, to make sure care is coherent and consistent. Purely medical interventions designed to address osteoporosis itself can be beneficial, but are incomplete. The true problem is fractures, which are often magnified by other frailty-related conditions appearing alongside osteoporosis.
- **Engage patients and the public.** Members of the general public may have heard of osteoporosis, but they seem content to believe that it will not affect them, and if it does, that it is not important enough to continue treatment. Moreover, osteoporosis societies in the region tend to be associations of medical specialists rather than patient-driven support groups as is the case for conditions such as HIV/AIDS and cancer, whose patient groups have successfully shaped the healthcare agenda. "It's only through [patient societies] that the true life experience of somebody living with osteoporosis can be heard. We have to take that story and speak about it," says Dr Jiwa. Until Asia-Pacific residents appreciate the challenge of osteoporosis and fractures, it is unlikely that policymakers and health systems will give the disease the attention it requires.
- **Pick the low-hanging fruit of secondary prevention.** Post-fragility fracture treatment for osteoporosis remains the exception rather than the rule, with only minorities of those affected receiving medication to improve BMD. As Dr Mithal notes, however, once a fragility fracture has made the presence of osteoporosis likely, there is no excuse not to commence treatment. FLSs, which are shown to improve treatment rates and reduce re-fractures, should be more widespread: if they are beginning to appear even in middle-income Thailand, richer economies should be able to put them in place.

- **Obtain better data on the disease and the outcome of interventions against it.** In the absence of information on the extent of fracture and osteoporosis or the effectiveness of potential measures to address them, government engagement is unlikely to occur. Although the broad scope of the problem is now undeniable, and some approaches have already proven worthwhile, knowledge gaps abound. A cautionary tale is the recent and surprising discovery that calcium supplements do more harm than good.<sup>130</sup>

<sup>130</sup> Ian Reid et al, "Calcium supplements: benefits and risks", *Journal of Internal Medicine*, 2015; "Myth-breaking bone scientists take top prize", *Radio New Zealand*, 11 November 2015

## APPENDIX: SCORECARD METHODOLOGY

### *Literature review*

The first step in the development of the scorecard was a rapid review of the key literature addressing osteoporosis in eight Asia-Pacific economies: Australia, Hong Kong, Japan, New Zealand, Singapore, South Korea, Taiwan and Thailand. The literature review was designed to inform the development of the scorecard and white paper by understanding the current osteoporosis situation in these economies, in particular the burden of disease and current policy efforts to prevent, detect and treat osteoporosis and fragility fractures.

We searched Embase and Medline using relevant subject headings and free text terms relating to osteoporosis and fragility fractures, combined with terms relating to Asia-Pacific in general and the eight economies we are studying. Searches were not limited by article type, but were limited to the last ten years. In addition to database searching, we searched the grey literature using a similar searching approach and keywords to identify policy documents and information not included in databases.

### *Scorecard development*

The literature review identified five key themes that became the domains for the scorecard; during scorecard development the prevention and policy domains were combined into a single domain. Therefore the final scorecard domains were:

1. Burden
2. Prevention and policy
3. Identification
4. Treatment

Each domain is made up of indicators which measure each economy's performance in responding to the challenge that osteoporosis and fractures create to enable a comparison across economies. The scorecard indicators are a series of questions that seek to assess and reflect how well each economy is responding to the challenges identified in the literature review.

The process of selecting indicators is pragmatic and partly driven by the availability of comparable data across all or most of the economies included. For example, several indicators within the scorecard use policy documents, such as national treatment guidelines, as their source. This is a pragmatic decision because these documents provide comparable data across these economies. However, we acknowledge that the practice set out in these documents may not reflect actual practice. Insights from interviewees were also used to validate and supplement some data points. Additionally, some issues are not easily translated into indicators therefore not all issues can be addressed directly in the scorecard. The scorecard aims to reflect the findings of the literature review as closely as possible.

### ***Scoring***

The information necessary to answer the indicator questions came from a range of sources: national/international statistics, policy documents, osteoporosis plans, global or national NGOs, the white paper interviewees, and academic literature. Indicators were populated using the most up-to-date, reliable and internationally comparable information available, focussing on data from the past ten years.

There are a total of 23 indicators, distributed across the five domains. Scored indicators are on a 0-2 scale, with 0 being the lowest score, 1 an intermediary (eg “partial”) score and 2 the maximum score. The scores are also colour-coded. In the case of binary indicators, the indicator response is “yes” or “no” (with some exceptions).

There are 11 non-scored indicators, where indicator data is presented in its raw form rather than translated into a score. There are eight within the burden domain, two in the identification domain and one in the treatment domain. Scoring would not have been appropriate in these cases because there is not a clear indication of what is “better” or “worse” in terms of responses. Additionally, because osteoporosis is an underdiagnosed condition, scoring would not have been appropriate within the burden domain because economies that are effective in identifying cases of osteoporosis could have appeared to be worse performing compared to economies that did not identify cases as well and therefore record lower prevalence.

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LONDON

20 Cabot Square

London

E14 4QW

United Kingdom

Tel: (44.20) 7576 8000

Fax: (44.20) 7576 8500

E-mail: london@eiu.com

NEW YORK

750 Third Avenue

5th Floor

New York, NY 10017

United States

Tel: (1.212) 554 0600

Fax: (1.212) 586 1181/2

E-mail: americas@eiu.com

HONG KONG

1301 Cityplaza Four

12 Taikoo Wan Road

Taikoo Shing

Hong Kong

Tel: (852) 2585 3888

Fax: (852) 2802 7638

E-mail: asia@eiu.com

GENEVA

Rue de l'Athénée 32

1206 Geneva

Switzerland

Tel: (41) 22 566 2470

Fax: (41) 22 346 93 47

E-mail: geneva@eiu.com